Assessment of nutritional anthropometric parameters in adult patients undergoing orthognathic surgery

Acompanhamento de parâmetros nutricionais antropométricos de pacientes adultos submetidos a cirurgia ortognática

Abstract

Purpose: This paper reports the assessment of nutritional anthropometric parameters of three patients who were submitted to orthognathic surgery followed by intermaxillary fixation and liquid diet.

Case description: This prospective case series describes the changes in nutritional parameters of three adult subjects aged 20 to 24 years, including one male and two females, who received elective orthognathic surgery followed by intermaxillary fixation with orthodontic elastics for 14 days. The hospitalized patients were instructed to go on a liquid diet with hypercaloric and hyperprotein intake. After discharge, the patients continued the liquid diet up to 28 days postoperatively. Data on weight loss, body mass index, triceps skinfold thickness, midarm circumference, and midarm muscle area were collected one week before surgery, one week after surgery, and four weeks after surgery. All three patients had severe weight loss (>2% weight loss per week).

Conclusion: The interaction between nutritionist and oral surgeon is essential in order to plan an adequate dietary intervention after orthognathic surgery to minimize occasional weight loss.

Key words: Adult; oral surgery; nutritional status; weight loss

Resumo

Objetivo: Este artigo apresenta o acompanhamento de parâmetros nutricionais antropométricos de três pacientes submetidos a cirurgia ortognática, seguida de bloqueio maxilomandibular (BMM) e dieta líquida.

Descrição do caso: Neste estudo prospectivo do tipo série de casos foram avaliados três pacientes adultos, com idade entre 20 e 24 anos, sendo um do sexo masculino e dois do sexo feminino, submetidos à cirurgia ortognática eletiva seguida de BMM, por meio de elásticos ortodônticos, por 14 dias. Os pacientes foram orientados a seguir uma dieta líquida, hipercalórica e hiperprotéica, enquanto estivessem hospitalizados. Após alta hospitalar, os pacientes permaneceram com dieta líquida até os 28 dias pós-operatórios. Os pacientes foram avaliados por nutricionistas em três momentos: 1 semana antes do procedimento cirúrgico, 1 semana após o procedimento cirúrgico e 4 semanas após o procedimento cirúrgico. Foram mensurados perda de peso e os parâmetros antropométricos: índice de massa corporal, dobra cutânea triciptal, circunferência do braço e área muscular do braço. Todos os pacientes tiveram perda de peso grave (>2% do peso corporal por semana).

Conclusão: A interação entre nutricionista e cirurgião bucomaxilofacial é essencial a fim de planejar adequadamente uma intervenção dietética no pós-operatório de cirurgias ortognáticas objetivando minimizar eventuais perdas de peso.

Palavras-chave: Adultos; cirurgia maxilofacial; estado nutricional; perda de peso

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Introduction

Orthognathic surgery is one of the modalities of oral and maxillofacial surgery that has developed the most in the last years, where this procedure allows for more rapid techniques with less morbidity, reducing intra- and postoperative complications. This surgical procedure involves an incision, removal of intraoral soft tissues, osteotomy and repositioning of the bone segments, for the correction of dental occlusion. Through this therapeutic procedure, significant dentofacial alterations are obtained which reflect not only functional reestablishment, but also aesthetic and emotional aspects, improving the patient self-esteem and social integration (1,2). Nutritional status is a factor that should be evaluated critically in the patient candidate for oral and maxillofacial surgery, because this evaluation furnishes the surgeon with an indication of how the patient will respond to the stress of the surgery, because in the intraoperative period the patient loses large amounts of liquids, blood and nutrients (2). The patient is submitted to intermaxillary fixation for approximately 2 to 6 weeks, without the possibility of chewing. The patient is therefore put on a liquid diet, which can result in substantial weight loss, with consequent impact on the nutritional status. In this period, the patient can show edema, pain and paresthesia, making eating difficult (3).

Weight loss (WL) is one of the major collateral effects in orthognathic surgery followed by intermaxillary fixation. During this time, the patient can lose up to 6 kg in the postoperative period, where a greater WL is seen in male patients (4). Body weight represents the sum of the compartments of minerals, total body water, glycogen, protein and fat. The body weight of an individual does not determine which portion is lean mass, fat or fluids, where it is a global measure of all the compartments. Therefore, alterations in weight do not specify which body compartment has been affected by malnutrition. However, weight is an important parameter in nutritional evaluation, since serious WL is associated with increased morbidity and mortality rates (5).

The capacity of the patient to respond to required energy needs as a result of trauma, surgical interventions, infectious states or fasting, depend basically on body deposits of potential energy and chemically active substrates, items recognized as nutritional status, which vary with the availability, assimilation and utilization of exogenous essential nutrients. Based on the known influence of nutritional status on the clinical outcome of surgery patients, all efforts should be made to recognize and identify patients with or in conditions of developing malnutrition in order to permit its correction and thereby favor the recovery of the patient. The methods of evaluation should be understood and include a global subjective evaluation, antropometry, and biochemical parameters as well (6).

The aim of the present work was to assess the anthropometric parameters of adult patients submitted to orthognathic surgery followed by intermaxillary fixation and liquid diet, determining alteration in weight and changes in body composition.

Case description

A prospective study of the case series type was conducted, in which three adult subjects, aged between 20 and 24 years, were evaluated (Table 1). The project was approved by the PUCRS Committee of Ethics in Research (Protocol nº 07/03574), and all subjects signed an informed consent form before data collection.

Table 1. Characteristics of the subjects and surgical procedures performed.

Subject	Sex	Age	Height	Orthognathic surgery
P1	male	20 years and 9 months	1.88 m	Osteotomy of maxilla (Le Fort I type) for maxillary advancement and sagittal osteotomy for mandibular setback
P2	female	24 years and 4 months	1.60 m	Osteotomia of maxilla (Le Fort I type) for maxillary advancement, sagittal osteotomy for mandibular setback and mentoplasty for anterior repositioning of the mentum
P3	female	20 years and 8 months	1.72 m	Osteotomy of maxilla (Le Fort I type) for maxillary advancement and sagittal osteotomy for mandibular setback

The subjects were submitted to orthognathic surgery followed by intermaxillary fixation, by means of orthodontic elastics, for a period of 14 days (7). The surgeries were performed by oral and maxillofacial surgeons of the Graduate Program in Dentistry of the PUCRS School of Dentistry under the Brazilian United Health System (SUS), in Hospital São Lucas (HSL/PUCRS), Porto Alegre, RS. After the procedure, the patients were instructed by the surgeons to follow a liquid diet, hypercaloric and hyperprotein, according to routine at HSL/PUCRS, while being hospitalized. After discharge, the patients remained on a liquid diet up to 28 days postoperative.

The patients were evaluated by a team of students and professors of the PUCRS School of Nutrition, in Porto Alegre, RS, Brazil, at three times: T1 – 1 week before the surgical procedure, T2 – 1 week after the surgical procedure, and T3 – 4 weeks after the surgical procedure. WL was determined, as well as the following anthropometric parameters: body mass index (BMI), triceps skinfold thickness (TST), midarm circumference (MC) and midarm muscle area (MMA).

The determination of WL, in relation to time, was based on the classification described by Blackburn and Bistrian (8), in which significant WL was considered for about 1 to 2% in one week or 5% in 1 month, and serious loss for more than 2% in the first week or greater than 5% in the first month.

Body mass index (BMI) is used to evaluate the nutritional condition of individuals (9), where it is calculated with the equation: BMI (kg/m^2) = weight (kg)/height $(m)^2$.

The triceps skinfold thickness (TST) is the measure most utilized in clinical practice to monitor nutritional status, where it can be determined by the following formula: Adequate TST (%) = [TST obtained (mm)/TST of the 50th percentile]×100.

Midarm circumference (MB) is utilized to estimate somatic protein and fatty tissue. Although it can be used as an independent measurement, it is frequently combined with TST to calculate the midarm muscle area (MMA) (5). Adequate MC can be determined by means of the equation: Adequate MC (%) = [MC obtained (cm)/MC of the 50th percentile]×100.

Midarm muscle area was obtained from the preceding measurements, based on the following equation: MMA (mm^2) = [MC (mm) – $\pi TST]^2/4\pi$.

Table 2 describes the classification of nutritional status based on the anthropometric parameters. The values of the anthropometric evaluation and of the WL for the three patients followed during the period of the study are described in Table 3.

Table 2. Classification of nutritional status based on the anthropometric parameters body mass index (BMI), triceps skinfold thickness (TST), midarm circumference (MC) and corrected midarm muscle area (MMAc).

Parameter	Classification
*BMI (kg/m^2)**	
<18.5	Low weight
18.5 to 24.9	Adequate or eutrophic
25 to 29.9	Underweight
>30	Obesity
30 to 34.9	Obesity class I
35 to 39.9	Obesity class II
≥40	Obesity class III
TST† and MC†	
<70%	Malnutrition serious
70 to 80%	Malnutrition moderate
80 to 90%	Malnutrition slight
90 to 110%	Eutrophy
110 to 120%	Underweight
>120%	Obesity
MMAc†	
Percentile >15	Normal
5 < Percentile <15	Malnutrition slight/moderate
Percentile <5	Malnutrition serious

* Source: OMS, 2000 (9)
† Source: Blackburn and Thornton, 1979 (10)

Table 3. Values of the anthropometric parameters body mass index (BMI), triceps skinfold thickness (TST), midarm circumference (MC), midarm muscle area (MMA) and weight loss (WL), and classification of nutritional status for subjects P1, P2 and P3 at times T1, T2 and T3.

	Weight (kg)	BMI (kg/m^2) classification	TST (mm) classification	MC (cm) Classification	MMA (mm^2) Classification	WL (%) classification
P1						
T1	78.40	22.08 Eutrophic	18.00 obesity	31.00 eutrophy	41.15 Normal	–
T2	75.60	21.29 Eutrophic	18.66 obesity	30.00 eutrophy	36.39 malnutrition slight/ moderate	3.57 serious
T3	75.00	21.10 eutrophic	18.33 obesity	30.00 eutrophy	36.82 malnutrition slight/ moderate	0.79 significant
WL total	–	–	–	–	–	4.36 significant
P2						
T1	51.00	19.92 eutrophic	20.00 eutrophic	24.50 eutrophy	19.93 malnutrition slight/ moderate	–
T2	48.90	19.10 eutrophic	16.83 eutrophic	24.50 eutrophy	22.89 Normal	4.11 serious
T3	49.30	19.25 eutrophic	16.66 eutrophic	25.00 eutrophy	24.61 Normal	0.81 significant
WL total	–	–	–	–	–	4.92 significant
P3						
T1	67.00	22.55 eutrophic	17.33 eutrophic	27.00 eutrophy	30.50 Normal	–
T2	61.80	20.77 eutrophic	17.00 eutrophic	26.50 eutrophy	29.15 Normal	7.76 serious
T3	61.00	20.53 eutrophic	17.66 eutrophic	26.00 eutrophy	26.81 Normal	1.29 significant
WL total	–	–	–	–	–	9.05 serious

Discussion

The anthropometric measurements are used widely for the determination of adaptations in response to training, in the selection of athletes and in studies of ethnic characterization. The quality control of these measurements results in more reliable data and more precise measurements. There is a method that examines the technical error of measurement (TEM) which determines the intra- and inter-examiner degree of precision in executing the anthropometric measurements (11). Studies reveal that there is a margin of error in conducting these measurements (12). The method for determining the technical error of measurement (TEM) allows anthropometrists to establish their degree of precision in executing and repeating anthropometric measurements (intra-examiner) and to compare their measurements with those of other anthropometrists (inter-examiner). This index is recommended by the *International Society for Advancement in Kinanthropometry* (ISAK) for the accreditation of anthropometrists in Australia (9). Periodic evaluations of TEM are conducted to control and minimize intra-examiner and inter-examiner variation among anthropometrists (12).
A substantial, unintentional WL in a relatively short span of time is a factor that can determine a certain degree of malnutrition or at least some nutritional deficiency. WL reflects the immediate incapacity to meet nutritional needs, and can consequently indicate nutritional risk. The percent WL is highly reflective of the extent of the disease (5). The three patients evaluated showed WL considered serious (>2% of body weight per week). In patient-1 (P1), total WL was 4.36%, close to the values for patient-2 (P2) (4,92%). In patient-3 (P3), her WL was even more substantial, corresponding to 9% of body weight. The patients remained eutrophic for BMI, TST and MC, except P2 at T2 normalizing by T3. In relation to MMA, only P2 showed values compatible with slight or moderate malnutrition.
Considering the ethical aspects a diet therapy intervention was planned in case the patients showed substantial WL at T2 of the study, where it was then instituted in all patients, because at this moment (T2) they showed WL considered serious. In P2, there was possibly a TEM in the data collection at T1, in the TST parameter, because in the classification of MMA a slight/moderate malnutrition was found, and after a loss of weight TST was found to be normal at T2 and T3.
WL caused by the use of intermaxillary fixation is so striking that this procedure has been utilized as treatment in patients with obesity class III. The loss of weight is on average 7% per month. In these cases, the patients are not submitted to surgical procedures, but only utilize a device similar and to an orthodontic appliance, limiting the opening of the mouth for chewing and forcing the patient to adhere to a pasty diet for a determined period, until he/she loses the weight desired (13).
The use of monocortical plates or bicortical screws for the fixation of the osteotomized segments in orthognathic surgery, provides sufficient stability and dispenses with the use of intermaxillary fixation (14). However, the use of intermaxillary fixation with elastics was instituted after orthognathic surgery for the purpose of providing patient with more comfort in the first weeks postoperative, until edema diminished, so that incised intraoral soft tissues and sutures could heal with little movement, besides guiding the mandible to its new post-surgical occlusion (7).
To assure an adequate reserve of nutrients in tissues, it is important to evaluate the nutritional status of the patient in the preoperative period, with particular attention to adequate intake of protein, ascorbic acid and vitamin A. The hematopoietic nutrients: iron, vitamin B12 and folic acid are of extreme importance, because their levels are affected directly by the loss of blood during surgery. The health care professional should look at nutritional therapy as an adjuvant, similar to analgesics and antibiotics, which accelerate the recovery process of the patient. Adequate nutrition is of extreme importance for the promotion of convalescence and tissue repair, augmenting the resistance of the patient to infections (6). In the postoperative, it is important to provide a balanced diet to reverse the catabolic metabolism resulting from the surgery and to accelerate the process of wound healing. During this step, it is important for the patient to receive a hypercaloric liquid diet with high energy density and with a goal of 35 to 40 kcal/kg/day. The patient should be instructed to have at least eight daily meals, or based on gastric capacity, to achieve the nutritional contribution proposed. The use of oral nutritional supplementation can be necessary. Thus, the success of an operation can depend on the adequate nutritional status of the patient, that is, the patient should be nutritionally competent to support a maximal response of immune defense mechanisms against infection as well as for wound healing (6).
Based on this work, new case-control studies are suggested, in which the nutritionist professional guides a group of patients from preoperative (case) and another group in the first week of postoperative (control) to determine the impact of nutritional guidance in the postoperative period of these patients.

Conclusions

The patients studied had a serious WL (> 2% of body weight per week). Based on these results, it is essential for the nutritionist to be involved with the patient's care in the pre- and postoperative period of orthognathic surgery, to plan an appropriate diet in order to minimize losses as a result of this procedure, thereby guaranteeing its success. It is important to point out that interdisciplinary treatment and the interaction among the health care professionals can help in the recovery of these patients, reflecting also on the final costs of the treatment.

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References

1. Murphy TC. The diary of an orthognathic patient aged 30¾. J Orthod 2005;32:169-74.
2. Chidyllo SA, Chidyllo R. Nutritional evaluation prior to oral and maxillofacial surgery. NY State Dent J. 1989;55:38-40.
3. Worrall SF. Changes in weight and body composition after orthognathic surgery and jaw fractures: a comparison of miniplates and intermaxillary fixation. Br J Oral Maxillofac Surg 1994;32: 289-92.
4. Behbehani F, Al-Aryan H, Al-Attar A, Al-Hamad N. Perceived effectiveness and side effects of intermaxillary fixation for diet control. Int J Oral Maxillofac Surg 2006;35:618-23.
5. Duarte AC, Castellani FR. Semiologia nutricional. Rio de Janeiro: Axcel; 2002.
6. Peres SP, Arena EP, Burini RC, Suguimoto RM. Uso de suplementos alimentares e estado nutricional de pacientes submetidos à cirurgia ortognática com bloqueio maxilo-mandibular. Rev Bras Nutr Clin 2006;21:28-32.
7. Epker NB, Fish LC. Dentofacial Deformities: integrated orthodontic and surgical correction. St Louis: The C.V. Mosby Company; 1986.
8. Blackburn GL, Bistrain BR, Maini BS, Schlamm HT, Smith MF. Nutritional and metabolic assessment of the hospitalized patient. J Parenter Enteral Nutr 1977;1:11-22.
9. OMS. The World Health Report 2000: Health Systems – improving performance. Genebra; 2000.
10. Blackburn GL, Thornton PA. Nutritional assessment of the hospitalized patients. Med Clin North Am 1979;63:1103-15.
11. Hawes MR, Marin AD. Human body composition. In: Eston R, Reilly T. editors. Kinanthropometry and exercise physiology laboratory manual tests, procedures and data. New York: Routledge Taylor & Francis Group; 2004. p. 5-43.
12. Perini TA, Oliveira GL, Ornellas JS, Oliveira FP. Cálculo do erro técnico de medição em antropometria. Rev Bras Med Esporte 2005;11:81-5.
13. Viterbo F. Ortodontia diet. Rev ABO Nac 2005;13:206.
14. Choi BH, Zhu SJ, Han SG, Huh JY, Kim BY, Jung JH. The need for intermaxillary fixation in sagittal split osteotomy setbacks with bicortical screw fixation. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2005;100:292-5.