Effect of prosthodontic rehabilitation on the nutritional status of maxillectomy patients in Indian subjects – A hospital based study

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ABSTRACT

Statement of problem: Malnutrition amongst cancer patients is a frequent finding. Patients face difficulty in mastication and deglutition due to defects in maxilla during post-surgical period.
Objective: Obturators help in restoring the function of maxillectomy patients. Therefore, it is important to assess their nutritional status of these patients after prosthodontic rehabilitation.
Materials and methods: Total 38 patients were enrolled in the span of one year, out of which 17 were dropouts. Surgical, intermediate and definitive obturators were fabricated as per requirement. Mini Nutritional Assessment (MNA) Performa and various blood bio chemical parameters like serum albumin, globulin, total protein, serum sodium, potassium, calcium, alkaline phosphatase and haemoglobin were used to assess the nutritional status. Assessments were made at three different time intervals; just before maxillectomy, 3 months after maxillectomy and 3 months after the delivery of definitive obturator.
Results: Nutritional status of the patients decreased three months after maxillectomy but increased three months after delivery of definitive obturator in comparison to baseline values. On application of one way ANOVA followed by Bonferroni correction, the mean difference of the MNA score of maxillectomy patients at three months after rehabilitation with definitive obturator was found to be statistically significant as compared to that obtained 3 months after maxillectomy and before maxillectomy ($P < 0.05$). Mean values of haemoglobin, albumin and total protein three months after rehabilitation with definitive obturator increased significantly from the values obtained three months after maxillectomy and just before maxillectomy ($P < 0.05$).
Conclusions: Prosthodontic rehabilitation with definitive obturator is one of the prime factors in the improvement of nutritional status and general health of the maxillectomy patients which is evident by the increment in MNA score and serum albumin, haemoglobin and total protein values.

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INTRODUCTION

Malnutrition has been defined as a subacute or chronic state of nutrition, in which a combination of undernutrition (insufficient food intake) and inflammation has led to a decrease in muscle mass, fat mass, and diminished function, i.e., immune function, cognitive function and muscle strength.[1] It is a common problem among maxillectomy patients which may be due to the local effect of the etiological factors like cancer or fungal infections or due to its treatment therapies i.e. surgical excision, radiotherapy and chemotherapy.[2]
Advancements in surgical techniques and technology have led to treatment of larger and more extensive cancers of the head and neck region.[3] This leads to significant improvement in the survival rate but also results in various functional and cosmetic problems in such patients. Patients may experience chewing problems which may result either because of poor dental status or trismus. It becomes difficult for the patient to wear dental prosthesis for about three months after surgery and not uncommonly even up to six months after radiotherapy or chemo-radiation, due to either radiation-induced mucositis, oral edema, tender oral mucosal surfaces, surgically induced changes in anatomy, or time needed to fabricate a new prosthesis.[4]
Quality of life of the maxillofacial patients is also affected, which make them psychologically weak and affects their ability to bear the trauma of surgical procedure. [5] Therefore, prosthetic restoration of the resulting defect is an essential step because it signals the beginning of patient's rehabilitation.[3] The goal of prosthodontic rehabilitation is to minimize morbidity, ensure a good QOL for the patients and uphold their self-image during their traumatic psychological adjustments.[6]
There are several studies that show a significant association between malnutrtion and malignancy.[2, 7, 8] Nevertheless, these studies were hampered by retrospective design and heterogenous patient groups with respect to the type of cancer, staging and treatment. Moreover, it is clear from these reports that no consensus exists regarding effect of prosthodontic rehabilitation on the nutritional status of maxillectomy patients.[9] Based on the facts discussed above, this study was designed to

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evaluate the effect of prosthodontic rehabilitation on the nutritional status of these patients.

MATERIALS AND METHODS

Sample size was calculated using G Power statistical software, where the power was set at 0.80, with effect size of 0.05 and a two tailed alternative hypothesis calculation of 0.07.

A total of 38 patients within age range of 18-60 years; irrespective of sex indicated for maxillectomy were enrolled consecutively from May, 2011 to April, 2012. These patients were thoroughly informed about the procedure and verbal and written consents were obtained from each patient. Ethical clearance was obtained from the Ethics Committee of the institution before starting the study (Ref. No. IESC/T-425).

Data could not be completed for 17 cases because of following reasons; six patients did not underwent maxillectomy due to psychological fear; three patients were treated with only palatal debridement; one patient died, four patients reported with recurrence of the cancer, three patients did not report during the process of fabrication of definitive obturator. Thus, only 21 patients were followed up to the 3rd assessment and completed all questionnaires at all intervals.

Treatment procedure

Surgical, intermediate and definitive obturators were fabricated as per requirement and healing conditions of the patients. Assessments for the evaluation of nutritional status and oral health status were made at three different time intervals i.e. before maxillectomy (T_0), three months after maxillectomy (T_1) and three months after delivery of the definitive obturator (T_2).

Pre surgically, surgical obturator was fabricated in auto-polymerising acrylic resin (DPI-RR, Cold cure, Dental Products of India, Mumbai, India) as per conventional method and was given to the patient. Surgical obturator was adjusted and inserted following resection by the surgeon or the prosthodontist.

Post surgically, patients were recalled 10-15 days after surgery and an intermediate obturator extending in to the defect was fabricated in heat cure acrylic resin (Travelon, Dentsply Limited, Addleston, UK). Patients were instructed regarding the insertion and removal of the prosthesis; maintenance of proper hygiene of both the defect and prosthesis, and were advised to remove the obturator at the time of sleeping and to store it in water with some antiseptic. Denture brush and denture cleansing tablets were advised for the cleaning of the prosthesis. They were recalled after 24 hours following placement of intermediate obturator to examine the defect area for any trauma or discomfort.

Definitive obturator was fabricated in heat cured material approximately three months after surgery when the complete healing of the wound had taken place. Instructions regarding cleaning of prosthesis and mastication were given to the patients.

Nutritional assessment:

1. Nutritional assessment with Mini Nutritional Assessment:

Several techniques are available for the assessment of nutritional status in patients. [10-14] MNA was used in this study because of its extensive validation in older patients and its previous use in cancer populations. [12, 15-19] In brief, the MNA consists of four additive items: anthropometric assessment (four questions), global evaluation (six questions), dietetic assessment (six questions), and subjective assessment (two questions). It consists of 18 questions and each answer has a numerical value and contributes to the final score, which has a maximum score of 30. It has threshold values of ≥ 24 for well-nourished, 17-23.5 for at risk of malnutrition, and <17 for malnourished.[15]

2. Nutritional assessment through blood bio chemistry

Blood samples of all the patients were taken to evaluate following parameters: Haemoglobin, Serum protein, Serum albumin, Serum globulin, Serum calcium, Serum phosphate, Serum alkaline phosphatase, Serum glucose, Serum sodium, and Serum potassium.

Serum albumin is a reflection of nutritional status and protein intake.[20] It also provides useful prognostic significance in cancer. Calcium, phosphate and alkaline phosphatase levels are useful in screening for metabolic bone diseases including vitamin D deficiency.[21] Total body potassium is an indicator of anabolic state. [22, 23] The effect of cancer on sodium and potassium is non- specific. The metabolic relationships between electrolytes, minerals, and cancer show no general abnormalities. Specific disorders of metabolism may be produced by hormone secreting tumours, and an increased utilization or excretion of minerals and electrolytes may result. [24]

Statistical Analysis

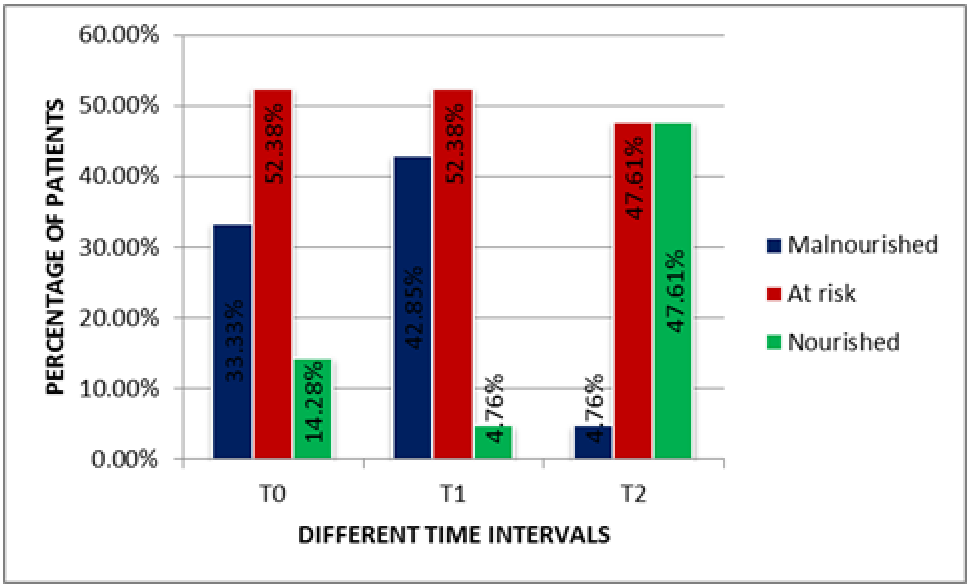
Nutritional parameters were analyzed for significant differences between the categorized variables, such as MNA and blood biochemistry values using repeated measure analysis of variance; one way ANOVA followed by post hoc analysis with bonferroni correction. Friedmann test was used to assess the changes in blood biochemistry value of alkaline phosphatase (as the standard deviation of these variables was computed to be high).

The analysis was performed using SPSS (version 15) and results were considered statistically significant for p values <0.05 with confidence interval of 95%.

RESULTS

In the present clinical study, it was found that MNA scores of patients decreased three months after maxillectomy but increased three months after rehabilitation with definitive obturator in comparison to baseline values.

Before maxillectomy, majority of the patients (52.38%) were at risk of malnutrition, 33.33% of the patients were malnourished and only 14.28% of the patients were nourished. Three months after maxillectomy, percentage of the patients at risk of malnourishment remained 52.38% but percentage of malnourished patients increased up to 42.85% and percentage of nourished patients decreased to 4.76%. Three months after rehabilitation with definitive obturator, percentage of patients at risk of malnourishment were 47.61% while only 4.76% of the patients were malnourished and 47.61% of patients were found to be nourished (graph 1).



Graph 1: Bar diagram showing nutritional status of maxillectomy patients at different time intervals

On application of one way ANOVA followed by Bonferroni correction, the mean difference of the MNA score of maxillectomy patients at three months after rehabilitation with definitive obturator was found to be statistically significant from the MNA score three months after maxillectomy (T_2-T_1) and before maxillectomy (T_2-T_0) ($P < 0.05$). But mean difference of MNA score before maxillectomy and three months after maxillectomy (T_0-T_1) was not statistically significant ($P > 0.05$) (table 1).

Table 1: Comparison of Nutritional Status of Maxillectomy Patients at Different Time Intervals (n=21)

Time interval	Mean difference (Nutritional Score)	Significance
T_0-T_1	0.024	0.983
T_1-T_2	-4.09	0.001
T_0-T_2	-4.07	0.001

T_0: Before maxillectomy, T_1: Three months post maxillectomy, T_2: Three months after definitive rehabilitation

Analysis of blood bio chemistry parameters showed a statistically significant increase in the mean values of haemoglobin, albumin and total protein at three months after rehabilitation with definitive obturator in comparison to values at three months after surgery and before maxillectomy. There was no statistically significant difference of these parameters before surgery and 3 months after maxillectomy (P>0.05) (table 2).

Table 2: Comparison of blood biochemistry variables of maxillectomy patients at different time intervals (n=21)

Time Interval	Haemoglobin		Albumin		Total Protein	
	Mean Difference	Significance	Mean Difference	Significance	Mean Difference	Significance
T_0-T_1	0.095	0.731	-0.014	1.0	-0.233	1.0
T_1-T_2	-1.600	0.001	-0.386	0.001	-0.419	0.001
T_0-T_2	-1.505	0.001	-0.400	0.001	-0.652	0.001

DISCUSSION

Modern day cancer therapy may contribute either directly or indirectly to altered nutritional status of the cancer patient. The potentially life-saving maxillectomy operation is extremely disabling making effective speech, mastication and swallowing virtually impossible.[25]

Reduced masticatory efficiency resulting from the tooth loss may lead to a change in the dietary preferences to compensate for the greater difficulty of eating certain foods.[26] Maxillectomy patients report significantly more chewing difficulties than normal people and a change in their food choices as per their preferences is not uncommon. [26, 27] Therefore, it is mandatory to assess maxillectomy patients for early signs of malnutrition and to provide them with adequate nutritional support along with the required treatment.

The findings of the present study showed that most of the patients were malnourished before maxillectomy. There was a further decline in the nutritional status of these patients after maxillectomy but an improvement in nutritional status was seen at three months after rehabilitation with definitive obturator.

These findings suggested that a large proportion of patients in the clinical oncology setting might benefit from rehabilitation. According to Ravasco et al (2007), metabolic effects of the disease and side effects of the therapy put the patient with malignant disease at risk of malnutrition.[28] Difficulties in biting, chewing and swallowing after surgery may lead to poor nutrient intake.[29]

The texture, temperature, consistency, nutrient content and frequency of oral feedings might be changed during and after treatment.[29] So, the balance between the proper supply of nutrient required for the wound healing and limitation of their availability due to altered oral status is disturbed. All these factors may lead to decreased nutritional status three months after surgery. Baeur et al (2002) reported high prevalence of malnutrition in cancer patients using SGA (subjective global assessment) performa.[10]

Psychosocial factors may be considered as reason for poor nutritional status.[30] Diagnosis of cancer often leave the patient in different psychological situations, where he/she confronts himself/herself with fear of isolation, fear of death and dying, fear of social stigma and social discrimination. This situation could somehow change food intake and, consequently, the nutritional status of the patient.[31] Wittenaar et al (2011) evaluated the malnutrition ratio in head and neck cancer patients undergoing surgical resection according to which prevalence of malnutrition in the period 0-3 months after surgery was significantly higher (25%) than in the periods more than 3-12 months and 12-36 months after treatment.[4]

Good retentive, stable and comfortable obturator prosthesis restores the masticatory function and deglutition in maxillecomy patients.[32] The placement of an obturator restores oro-nasal separation to allow an increase in intraoral pressure and a decrease in nasal airflow rate. It provides immediate improvement in speech articulation and intelligibility, voice quality and swallowing that approximates pre-surgical function enabling the patient to eat and drink immediately; which may be a reason for increased nutritional status of these patients after definitive rehabilitation.[33] As the time passes, the patient adapts by restructuring him/herself psychologically, thereby minimizing the side effects of treatment.[31]

Results of the present study also showed statistically significant change in mean difference of albumin, total protein and haemoglobin 3 months after delivery of definitive obturator as compared to their levels before surgery and 3 months after surgery.

Reduced synthesis of the albumin is usually a consequence of intake deficits.[2] The ongoing inflammatory response in cancer patients may also lead to reduced concentration of albumin in such patients.[34] The nutritional support for maxillectomy patients associated to an oral diet achieved a significant increase in the total caloric ingestion resulting in increased values of nutritional markers. Definitive obturator enables a maxillectomy patient to swallow, speak and chew effectively. So, an increase in serum albumin, total protein and haemoglobin could signify an anabolic response in these patients.

Gonclaves et al (2005) found an increase in value of albumin and haemoglobin after nutritional intervention in cancer patients subjected to radiotherapy.[35] According to Yao et al (2011), albumin levels increased significantly after dietary implementation in head and neck cancer patients who underwent surgical excision. They postulated that nutritional support after operation can significantly improve the nutritional status of the patients, reduce the infectious complications and improve the prognosis.[36] In conclusion, definitive rehabilitation of maxillectomy defects is one the prime factor in improvement of nutritional status and general health of the patients which is evident by the increase in MNA score and blood nutritional marker values. The improvement of nutritional status may also be attributed to other reasons like elimination of etiological factor, improvement in body metabolism, improved nutritional intake and psychological well-being of these patients.

Limitations of the study: Study with longer follow up and large sample size is required.

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