

Prosthetic Rehabilitation with Use of Palatal Augmentation Prosthesis in Patients Affected by Functional Limitations of the Tongue

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Abstract

In this study six patients with oral carcinoma were subsequently subjected to surgery. Following surgical operation, patients highlight functional and psychosocial problems such as dysphagia, dysarthria and difficulties in everyday life.

These issues are much greater as the tongue is affected by the tumor. The removal of part or all of the tongue, generally associated to teeth loss, is related to the severity of functional problems for the patient such as chewing, phoning and swallowing. To improve their clinical conditions, patients underwent prosthetic rehabilitation through the use of the Palatal Augmentation Prosthesis (PAP).

The use of this device showed satisfactory results under all considered profiles. Subsequently, lingual pressure measurements were made both in static and dynamic phase before and after the use of the PAP. The use of this device experienced significant clinical improvements, evaluated also by two questionnaires: the first one, on general satisfaction with the PAP and specific satisfaction regarding comfort, mastication, phonetics, aesthetics, ease of cleaning and self-esteem and the second one, about the OHIP-14 items, referring to seven dimensions of impact; also phonetic tests for speech evaluation - with the help of a speech therapist - have been performed.

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Introduction

Oral cancer is a malignant neoplasia that mostly originate from epithelial tissues that cover the oral cavity. The oropharyngeal regions, sites of possibly cancerous lesions, are the tongue's third (most frequent), palatine and lingonous tonsils, tonsillary pits and pins, soft palate and ugly.¹⁻² Oncologic patients are often subjected to extensive demolition surgery and they have as a consequence, depending on the extent of its involvement in the disease, several problems due to poor lingual functionality. These limitations of the lingual capabilities may have several consequences on speech and feeding, as well as on quality of life and social relationships. In these

patients, the most important problem to be solved is about nutrition, considering their particular therapeutic path and age no longer young, but do not underestimate all the other physical and psychosocial disabilities that affect their quality of life. Therefore it is necessary to evaluate these patients both under the anatomical-functional and the psychological aspects. In this work we analyzed six oncological patients undergone hemiglossectomy or/and hemimandibulectomy and presenting the above-mentioned limitations of lingual functionality.³⁻⁴ After selecting the patients, we evaluated them to fill out two questionnaires on Quality Of Life (OHIP-14 and Vas Method), on the same day we tested pharyngeal swallowing pressure, performed phonetic tests and we took the impressions. After one week we started rehabilitating with PAP and after two months of its use we repeated the same tests previously performed.⁵

This device is an intraoral prosthesis, characterized by the increase of the component of the palate, used for the treatment of dysphagia and dysarthria, thanks to the restored contact between the tongue and the palate. The purpose

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of this kind of prosthesis is to allow a swallowing easier in patients with dysphagia, as well as an improvement of the speech.⁶ These patients affected by dysphagia showed a lack of (or however greatly reduced) ability to properly conduct food within the oral cavity due to functional limitation of the tongue. Therefore, they were treated with PAP in order to restore (or at least improve) the functional capacity of the tongue during the swallowing phases.

Materials and methods

In this study we present the QOL evaluation in six patients treated with tongue resection, rehabilitation with the use of PAP and the resulting improvement in the QOL of patients.⁷

Six patients with the following clinical history were selected.

Patient n.1: male, age 77, affected by tongue carcinoma, undergone hemi glossectomy, subsequently subjected to radiotherapy and presenting, as an associated pathological condition, a clinical history of diabetes.

Patient n.2: female, age 70, affected by oral floor carcinoma, undergone hemi glossectomy and hemi mandibulectomy, subsequently subjected to chemotherapy and radiotherapy and presenting, as an associated pathological condition, a clinical history of Parkinson's disease.

Patient n.3: male, age 75, affected by front pharyngeal pillar carcinoma, undergone hemi glossectomy, no chemotherapy or radiotherapy, no pathological condition associated.

Patient n.4: male, age 72 affected by tongue/oral floor carcinoma, undergone hemi glossectomy and oral floor resection, subsequently subjected to chemotherapy and presenting, as an associated pathological condition, a clinical history of osteoradionecrosis of the jaw

Patient n.5: female, age 66 affected by front pharyngeal pillar carcinoma, undergone hemi glossectomy. no chemotherapy or radiotherapy and presenting, as an associated pathological condition, a clinical history of osteoradionecrosis of the jaw.

Patient n.6: male, age 67, affected by tongue/oral floor carcinoma, undergone hemi glossectomy and oral floor resection,

subsequently subjected to chemotherapy and radiotherapy, no pathological condition associated (Table 1). We evaluated QOL of our patients with two questionnaires.⁸⁻⁹

In the first one, VAS Method, we can evaluate general satisfaction with the PAP and specific satisfaction regarding comfort, mastication, phonetics, aesthetics, ease of cleaning and self-esteem using 10-cm visual analogue scales (VAS). The anchor words were "totally dissatisfied" and "completely satisfied." Subjects were asked to draw a vertical line at a point on the horizontal line which best represented their response. We used VAS from point "0" to "10".¹⁰

The second questionnaire is the theoretical domains and functional items of the original short form of the Oral Health Impact Profile (OHIP-14): Theoretical Domains OHIP-14 Item. The OHIP-14 items refer to seven dimensions of impact, with participants asked to disclose the frequency of impact on Likert scales where: 0 = never; 1 = hardly ever; 2 = occasionally; 3 = fairly often; 4 = very often.

OHIP-14 consists of 14 questions, which measures the quality of life in seven fields of functional limitations, physical problems, mental and emotional problems, physical handicaps, mental and emotional handicaps, social handicaps and complete handicap. In this questionnaire, question 1 of each two questions evaluates one of those fields.

Patient	Age	Clinical history	Surgery	CT/RT	Associated pathological conditions
1)	77	Tongue carcinoma	Hemiglossectomy	N/Y	Diabetes
2)	70	Oral floor carcinoma	Hemiglossectomy and Hemimandibulectomy	Y/Y	Parkinson's disease
3)	75	Front pharyngeal pillar carcinoma	Hemiglossectomy	N/N	-
4)	72	Tongue/oral floor carcinoma	Hemiglossectomy and oral floor resection	N/Y	Osteoradionecrosis of the jaw
5)	66	Front pharyngeal pillar carcinoma	Hemiglossectomy	Y/Y	Osteoradionecrosis of the jaw
6)	67	Tongue/oral floor carcinoma	Hemiglossectomy and oral floor resection	Y/Y	-

Table 1. QOL evaluation in six patients treated with tongue resection, rehabilitation with the use of PAP and the resulting improvement in the QOL of patients.

The interviewed answers each of these questions in relation to experiencing a problem arising from the teeth and the oral condition

during the past twelve months.

On the whole, a score ranging between "0" and "56" is calculated for each subject. Higher scores indicate a lower quality of life for the subjects.¹¹

As mentioned, problems related to surgical operation have led to aesthetic and functional problems due to poor lingual mobility.¹² As regarding dysphagia and the bolus transportation, we measured the pharyngeal swallowing pressure using a manometric catheter. The catheter was inserted into the cervical esophagus through the nostril and fixed in reference to pressure at the upper esophagus sphincter.¹³

As regarding dysarthria, we evaluated the speech using phonemic tests during which patients were invited to pronounce a list of 56 words, marking the correct phonemes, distorted, omitted or replaced.¹⁴

Questionnaires, pharyngeal swallowing pressure measurements and phonemic tests were performed all on the same day.

After a week we started rehabilitating with PAP.

To accomplish PAP, the following procedure was performed (as seen in figures 1-9): after taking the impressions and the construction of the upper mobile prosthesis for edentulous patients or the realization of an acrylic plaque for patients having their own elements, a quantity of Kerr steared pasta (or wax or even self-curing acrylic) was added to palatal area.

At this point, the added material was functionalized by asking the patient to swallow; other layers of material were then added in order to achieve satisfactory functionality, both as regards the oral swallowing phase and the phonetic.¹⁵

After two months of PAP use, for the second time patients completed the same QOL questionnaires, we measured pharyngeal swallowing pressure again and we repeated phonetic tests.



Figure 1. The Remaining Portion of the Tongue.



Figures 2,3. Step 1-Manufacture of the Prosthesis.



Figures 4-6. Step 2- Functionalization of the Prosthesis.



Figures 7,8. Step 3-Definitive appearance of the Palatal Augmentation Prosthesis.



Figure 9. The Prosthesis Inside the Patient's Mouth.

Results

We evaluated pharyngeal pressure during swallowing, in two stages: one week before starting rehabilitation with PAP (Time 0) and two months after its use (Time 1), asking patients to swallows twenty times (Table 2).¹⁶

We evaluated the QOL of our patients with two questionnaires (Table 3, 4), one week before PAP's insertion (Time 0) and two months later (Time 1). With regard to dysarthria rehabilitation, we evaluated patients using phonemic test with the same timing as the other tests performed (Table 5).

Patient	Age	Surgery	Pharyngeal pressure (Time 0)	Pharyngeal pressure (Time 1)
1)	77	Hemiglossectomy	103.2/8.8 mmHg	131.4/6.1 mmHg
2)	70	Hemiglossectomy and hemi mandibulectomy	107.7/9.8 mmHg	136.1/7.3 mmHg
3)	75	Hemiglossectomy	104.2/9.1 mmHg	134.5/6.9 mmHg
4)	72	Hemiglossectomy and oral floor resection	101.3/8.4 mmHg	130.6/6.2 mmHg
5)	66	Hemiglossectomy	104.6/9.9 mmHg	130.4/7.1 mmHg
6)	67	Hemiglossectomy and oral floor resection	106.1/9.2 mmHg	134.9/6.9 mmHg

Table 2. Pharyngeal pressure evaluation during swallowing, in two stages: one week before starting rehabilitation with PAP (Time 0) and two months after its use (Time 1).

Patient	Age	Surgery	OHIP-14	VAS Method
1)	77	Hemiglossectomy	30	47
2)	70	Hemiglossectomy and Hemimandibulectomy	28	50
3)	75	Hemiglossectomy	32	42
4)	72	Hemiglossectomy and oral floor resection	29	43
5)	66	Hemiglossectomy	27	47
6)	67	Hemiglossectomy and oral floor resection	26	39

Table 3. One Week before PAP's Insertion (Time 0).

Patient	Age	Surgery	OHIP-14	VAS Method
1)	77	Hemiglossectomy	56	17
2)	70	Hemiglossectomy and Hemimandibulectomy	31	26
3)	75	Hemiglossectomy	52	19
4)	72	Hemiglossectomy and oral floor resection	48	22
5)	66	Hemiglossectomy	53	26
6)	67	Hemiglossectomy and oral floor resection	49	23

Table 4. Two Months Later (Time 1).

Patient	Age	Correct/Distorted/Omitted/ Replaced words (Time 0)	Correct/Distorted/Omitted/ Replaced words (Time 1)
1)	77	39	6
2)	70	54	3
3)	75	43	9
4)	72	50	6
5)	66	49	6
6)	67	52	7

Table 5. Evaluated Patients using Phonemic Test with Regard to Dysarthria Rehabilitation.

Discussion

Regarding pharyngeal swallowing pressure, it is remarkable that the mean pressure with PAP was found to be significantly greater compared to that without PAP; this device allows a correct bolus transit, thanks to the renewed contact between tongue and palate.¹⁷ This leads to increased pharyngeal pressure during swallowing. The restored contact between the palate (which is increased in thickness) and the tongue allows a correct transit of food during the oral phase of swallowing. Two months after application, the patient was able to orally consume three meals a day like pasta, fish and fruit, except for foods that are particularly difficult to swallow, like meat and some kind of vegetables.

For what concerns the QOL, the analysis of the questionnaires results in a clear improvement in the comfort, chewing, aesthetics and functionality of the patients; results indicate an increase in overall satisfaction and self-esteem, a re-established serenity of mind and a remarkable improvement in relationship life. So the results were positive both from the psychological and functional point of view. Five out of six patients accepted and kept PAP in the mouth as they found improvements in their daily lives. Only one patient decided not to continue using PAP due to a limited opening of the mouth making it impossible to use it.¹⁸

With regard to dysarthria, the comparison between phonemic tests at Time 0 and Time 1 shows an excellent improvement: the number of omitted, distorted or replaced words is reduced considerably as the number of correct words increases; all this results in improved speech and consequently also on the quality of life of the patients.

Conclusions

The use of PAP restored a correct connection between palate and tongue; this led to greater pharyngeal pressure during the swallowing phase and therefore to a better transit of food. In conclusion, we can state that PAP represents an effective therapeutic remedy in cases of absent or reduced lingual mobility, due to both emiglossectomy and demolition interventions which result in a lingual mobility deficit.

Declaration of Interest

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References

1. Valentini V, Terenzi V, Cassoni A, Bosco S, Brauner E, Pompa G. Giant Cell Lesion or Langerhans' Cell Histiocytosis of the Mandible? A Case Report. *Eur J Inflamm* 2012;10(1):159-64.
2. Walker DM, Boey G, McDonald LA. The pathology of oral cancer. *Pathology* 2003;35(5):376-83.
3. Cassoni A, Valentini V, Della Monaca M, Pagnoni M, Prucher GM, Brauner E, et al. Keratocystic Odontogenic Tumor Surgical Management: Retrospective Analysis on 77 Patients. *Eur J Inflammation* 2014;12(1):209-15.
4. De Campora E, Radici M, De Campora L. I tumori del pavimento orale. In 87° Congresso Nazionale SIO; 24-27 Maggio; Cagliari, 2000.
5. Marunick M, Tselios N. The efficacy of palatal augmentation prostheses for speech and swallowing in patients undergoing glossectomy: a review of the literature. *J Prosthetic Dentistry* 2004;91(1):67-74.
6. Ono T, Hori K, Nokubi T. Pattern of Tongue Pressure on Hard Palate During Swallowing. *Dysphagia* 2004;19(4):259.
7. Laaksonen JP, Loewen IJ, Wolfaardt J, Rieger J, Seikaly H, Harris J, Speech After Tongue Reconstruction and Use of a Palatal Augmentation Prosthesis: An acoustic case study. *Can J Speech-Language Pathol Audiology* 2009;33(4):196-203.
8. Brauner E, Pompa G, Quarato A, Jamshir S, De Angelis F, Di Carlo S, et al. Maxillofacial prosthesis in dentofacial traumas: A retrospective clinical study and introduction of new classification method. *BioMed Res Int* 2017;13:1-8.
9. De Angelis F, Pignatiello G, Brauner E, Piccoli L, Pompa G, Di Carlo S. Accuracy and precision of an intraoral scanner in complex prosthetic rehabilitations: An in vitro study. *J Int Dent Med Res* 2017;10:52-8.
10. Candel-Marti E, Peñarrocha-Oltra D, Peñarrocha-Diago MA, Peñarrocha-Diago M. Satisfaction and quality of life with palatal positioned implants in severely atrophic maxillae versus conventional implants supporting fixed full-arch prostheses. *Med Oral Patol Oral Cir Buccal* 2015;20(6):751-56.
11. Locker D, Allen PF. Developing short-form measures of oral health-related quality of life. *J Public Health Dent* 2002;62(1):13-20.
12. Brauner E, Valentini V, Jamshir S, Guarino G, Battisti A, Fadda MT, et al. Retrospective review of 78 rehabilitated head and neck postoncological patients: A new classification method. *Minerva Stomatologica* 2016;65(1):17-38.
13. Hono T, Hono R, Fujishima. Effect of palatal augmentation prosthesis on pharyngeal manometric pressure in a patient with functional dysphagia: a case report. *J Prosthodont Res* 2017;61(4):460-63.
14. De Carvalho-Teles V, Ubirajara SL, Gielow I. Speech Evaluation After Palatal Augmentation in Patients Undergoing Glossectomy. *Arch Otolaryngol Head Neck Surg* 2008;134(10):1066-70.
15. Robbins KT, Bowman JB, Jacob RF. Postglossectomy Deglutitory and Articulatory Rehabilitation With Palatal Augmentation Prostheses. *Arch Otolaryngol Head Neck Surg* 1987;113(11):1214-18.
16. Okayama H, Tamura F, Kikutani T, Kayanaka H, Katagiri H, Nishiwaki K. Effects of a palatal augmentation prosthesis on lingual function in postoperative patients with oral cancer: coronal section analysis by ultrasonography. *Odontology* 2008;96(1):26.
17. Pompa G, Saccucci M, Di Carlo G, Brauner E, Valentini V, Di Carlo S, et al. Survival of dental implants in patients with oral cancer treated by surgery and radiotherapy: A retrospective study. *BMC Oral Health* 2015;15:5.

18. Brauner E, Valentini V, Jamshir S, Battisti A, Guarino G, Cassoni A., et al. Two clinical cases of prosthetic rehabilitation after a tumor of the upper maxilla. *Eur Rev Med Pharmacol Sci* 2012;16:1882-90.