

## RESEARCH ARTICLE

# Prospective Evaluation of Quality of Life in Patients Undergoing Primary Surgery for Oral Cancer: Preoperative and Postoperative Analysis

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### Abstract

**Background:** The purpose of the present study was to compare the preoperative and postoperative health related quality of life (HRQoL) of a sample of patients undergoing primary surgery for oral cancer in 2012-13. **Materials and Methods:** A cross-sectional, prospective study of 54 patients in a Brazilian population was performed. HRQoL was measured preoperatively (after histopathological diagnosis) and postoperatively (2 months after surgery) using the University of Washington Quality of Life Questionnaire (UW-QOL). Clinicopathological, sociodemographic and lifestyle data were collected. Results: Surgery had a negative impact on most HRQoL domains, but pain, mood and anxiety scores were significantly improved. Most patients rated their health-related and overall postoperative HRQoL as good or very good. **Conclusions:** The UW-QOL was efficient at measuring HRQoL in our sample of patients with oral cancer. Surgery had a negative impact on HRQoL, especially due to sequelae affecting the stomatognathic system, yet patients classified their postoperative health-related and overall QoL as positive. Qualitative studies are necessary for confirmation of our results and further exploration.

**Keywords:** Health related quality of life- oral cancer- head and neck cancer- treatment- Brazil

*Asian Pac J Cancer Prev*, **18 (8)**, 2093-2100

### Introduction

The increasing prevalence of chronic degenerative diseases, especially malignancy in its many forms, reveals an important change in the profile of morbidity and mortality worldwide (Funk et al., 2014). Head and neck cancer (HNC) is considered the seventh-most common malignancy in the world and accounts for 5% of all cancers in the Western world (Ringash, 2015; Rettig and D'Souza 2015). HNC may originate in the oral cavity (40%), the pharynx (15%), the larynx (25%) or in other structures such as the thyroid and salivary glands (Lambert et al., 2011). Asian countries show about 70% of HNC (Chang et al., 2015).

Squamous cell carcinoma (SCC), the most prevalent type of lesion in HNC, is particularly common in the oral cavity (Rao et al., 2013; Rana et al., 2015). Malignant oral tumors are generally associated with poor prognosis and a 5-year survival rate of up to 50%, especially due to late diagnosis (Lambert et al., 2011). Based on global evidence, Simard et al., (2014) concluded that the etiology

of oral cancer is multifactorial, with smoking, excessive alcohol consumption and betel nut chewing as the most prominent factors. According to the GLOBOCAN (2012), the following incidences per continent were estimated for oral cavity cancer: North America with 28,567 (1.6% of all cancers), Central America with 3185 (1.6% of all cancers), South Africa with 15,868 (2.0% of all cancers), Europe with 61,416 (1.8% of all cancers), Asia with 168,850 (2.5% of all cancers), Africa with 17,276 (2.0% of all cancers) and Oceania with 1,351 (1.9% of all cancers). In Brazil, we can observe an incidence of 15,490 (2.6%) cases according to the National Cancer Institute (INCA, 2015).

Oral cancer treatment is clearly associated with a loss of quality of life (QoL) of patients and their caregivers, due to significant functional, esthetic and emotional changes (Flexen et al., 2012; Lango et al., 2014; Barber et al., 2015; Rigoni et al., 2016). Following diagnosis, treatment often leads to deterioration in basic functions such as chewing, breathing, salivation, swallowing and speech (Laraway et al., 2012; Laraway and Rogers, 2012,

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Handsichel et al., 2013). Surgery is the mainstay of initial definitive oral cancer treatment, but ionizing radiation has lately become an important modality of non-surgical and surgical treatment for oncological conditions (Akkas et al., 2013; Loimu et al., 2015; Licitra et al., 2016). The choice of treatment depends on the characteristics of the primary tumor (stage, site, histopathology, previous treatment, and lymph node involvement), the patient (age, overall health condition, tolerance to treatment, lifestyle, consent, and socioeconomic status) and the medical team (Chinn and Myers, 2015).

The measurement of QoL in patients with malignant tumors has been given much attention over the past few years (Farooqui et al., 2013). The WHO defines QoL not only as the absence of disease and infirmity, but as the ability of individuals to lead a productive and enjoyable life. QoL is subjective and multidimensional and includes the domains of physical health and functioning, mental health, social functioning, satisfaction with treatment, concerns about the future and general well-being (Laraway and Rogers, 2012; Farooqui et al., 2013; Parkar and Shah, 2015). On the other hand, Health Related Quality of life (HRQoL) has a focus on patients' perspectives regarding their disease and therapy applied (Farooqui et al., 2013; Barrios et al., 2015; Carrillo et al., 2016).

Several QoL questionnaires have been proposed, including the EORTC (European Organization for Research and Treatment of Cancer), the FACT (Functional Assessment of Cancer Therapy) and the UW-QOL (University of Washington Quality of Life Questionnaire), which takes general well-being into account (Rathod et al., 2015; Rogers et al., 2015). According to some authors (Laraway et al., 2012; Ojo et al., 2012; Boyapati et al., 2013), the best of these questionnaires is the UW-QOL, now in its fourth version. The purpose of the present study was to compare the preoperative and postoperative HRQoL of a sample of patients submitted to primary surgery for oral cancer.

## Materials and Methods

### *Selection of patients*

In this cross-sectional, prospective study, we evaluated 83 patients with conclusive diagnoses of oral cancer. The patients were treated at an oncology referral center (Hospital Haroldo Juaçaba, Ceará Cancer Institute) in Fortaleza (Ceará, Northeastern Brazil) over a 15-month period (2012-2013). The sample included malignant tumors of the oral cavity located on the anterior two thirds of the tongue, floor of the mouth, hard palate, alveolar ridge, retromolar area, oral mucosa and lip mucosa (Lambert et al., 2011; Chinn and Myers, 2015).

The final sample consisted of 54 patients submitted to primary surgery for tumor resection. The inclusion criteria were a conclusive preoperative diagnosis of oral cancer, treatment with primary surgery and informed written consent. The exclusion criteria were primary lesions of extra-oral origin, oral metastases from other organs, previous treatment for HNC, and non-surgical tumor treatment (e.g., radio/chemotherapy).

Clinicopathological and sociodemographic data

were recorded on spreadsheets designed for the study. The parameters included gender, age, race, level of schooling, marital status, occupation, place of birth, origin of referral, religion, location of tumor, histopathological diagnosis, clinical stage of tumor and oncological therapy administered. Lifestyle factors (smoking, alcohol consumption and sun exposure) were also recorded.

QoL was measured with the UW-QOL, a questionnaire created in 1990 specifically for HNC patients. The instrument, which has been validated in Brazil (Vartanian et al., 2006), provides a comprehensive evaluation of QoL, with good levels of acceptability, practicality, reliability and responsiveness. The fourth and current version contains 12 questions related to specific domains or functions of the head and neck region and to activity, recreation, pain, mood and anxiety. Three to five categories of response are provided and translated into scores from 0 (worst) to 100 (best). The instrument also contains three general questions. The first of these ("a") asks patients to compare health-related QoL over the preceding 7 days to health-related QoL one month before developing cancer; the second question ("b") asks patients to rate health-related QoL over the preceding 7 days; and the third question ("c") asks patients to rate overall QoL over the preceding 7 days.

The patients were asked to fill out the questionnaire preoperatively (after the histopathological diagnosis) and two months after surgery. The questionnaire was individual and self-administered (illiterate participants had the questionnaire read aloud by the investigator).

The study protocol was previously approved by the research ethics committees of the Federal University of Ceará (UFC) and the Ceará School of Oncology (ECO) and filed under entry numbers 448.137 and 468.119, respectively. All subjects accepted the invitation to participate and gave their informed written consent.

### *Statistical Analysis*

Categorical data (n, %) were compared and analyzed using Fisher's exact test and the chi-square test. The significance of the difference between preoperative and postoperative (mean  $\pm$  standard deviation) QoL scores was quantified with Wilcoxon's test for nonparametric data. The data were organized on Microsoft Excel spreadsheets and exported to SSPS for analysis. The level of statistical significance was set at 5% ( $p < 0.05$ ) in all analyses.

## Results

### *Sample characteristics*

The average age in our sample of 54 patients was  $61.1 \pm 13.9$  years. The male gender was predominant ( $n=39$ ; 72.2% vs.  $n=15$ ; 27.8%). Race was self-reported as indigenous or brown ( $n=32$ ; 59.3%), white ( $n=16$ ; 29.6%) or black ( $n=6$ ; 11.1%).

Overall, the level of schooling was low. Fifteen (29.4%) subjects were illiterate, 17 (33.3%) had completed elementary school, and 17 (33.3%) were elementary school dropouts ( $p=0.001$ ). Two subjects had been to high school, but only one graduated ( $n=1$ ; 2.0% each). Most patients ( $n=32$ ; 59.3%) were married, 14 (25.9%)

Table 1. UW-QOL Scores of 54 Patients with Oral Cancer Submitted to Surgical Resection. Fortaleza, Ceará, Brazil. 2012-13

Domains	Preoperative	Postoperative	p-value
Pain	68.4±33.2	89.5±23.7	0.003*
Appearance	82.9±21.8	77.0±22.8	0.274
Activity	86.4±19.0	84.2±22.8	0.718
Recreation	86.6±17.3	77.4±22.4	0.472
Swallowing	78.5±25.4	69.3±32.4	0.106
Chewing	63.6±34.2	57.9±41.1	0.250
Speech	84.3±22.9	74.6±28.5	0.182
Shoulder function	98.2±10.9	85.1±25.3	0.119
Taste	92.2±16.2	74.6±34.2	0.001*
Saliva	97.4±9.0	84.2±26.6	0.180
Mood	67.8±27.2	80.3±30.3	0.030*
Anxiety	50.0±33.7	84.2±33.6	<0.001*

UW-QOL=University of Washington Quality of Life Questionnaire.  
 \* p<0.05, Wilcoxon's test.

were single, 4 (7.4%) divorced and 4 (7.4%) widowed (p<0.001). Three quarters (73.9%) were professionally active, while 26.1% were formally retired (p=0.019). The most frequently reported occupation was cropper (n=15; 44.1%).

More than half the subjects (n=34; 63.0%) were born in the hinterland of Ceará, while 7 (13.0%) were from Fortaleza, 11 (20.4%) were born in other districts of the metropolitan region, and 2 (3.7%) hailed from other states (p<0.001). Nearly half (n=28; 51.9%) were referrals from facilities in the hinterland, followed by referrals from facilities in Fortaleza (n=18; 33.3%) and the metropolitan region (n=8; 14.8%) (p=0.049). Catholicism was the most frequently reported religion (n=46; 85.2%) (p=0.001).

#### Clinicopathological profile

Tumors were most often located on the tongue (n=14; 25.9%), followed by the lips (n=12; 22.2%), the floor of the mouth (n=9; 16.7%), the alveolar ridge (n=7; 13.0%), the cheek mucosa and hard palate (n=4; 7.4%), the retromolar area (n=3; 5.6%) and inside the maxillary bone (n=1; 1.9%).

SCC (n=46; 85.2%) was the predominant histological diagnosis, followed by carcinoma in situ (n=2; 3.7%), adenocarcinoma (n=2; 3.7%), low-grade polymorphous adenocarcinoma (n=1; 1.9%), clear-cell polymorphous adenocarcinoma (n=1; 1.9%), chondroblastic osteosarcoma (n=1; 1.9%) and adenoid cystic carcinoma (n=1; 1.9%).

With regard to tumor stage, 18 (36.7%) tumors were classified as T1, 7 (14.2%) as T2, 10 (20.4%) as T3, 12 (24.4%) as T4, and 2 (4.1%) as Tis. Most patients (n=34; 75.6%) had no palpable positive cervical lymph nodes, but palpation was positive in 11 cases (24.4%). In 33 subjects (61.1%), no evident or distant metastases were observed (n=20; 37.0%). Tumors were most often classified as stage 4 (n=20; 40.8%), followed by stage 1 (n=17; 34.7%), stage 2 (n=7; 14.3%) and stage 3 (n=5; 10.2%).

The most frequent treatment scheme was surgery alone

Table 2. Pre- and Postoperative Evaluation of Importance of Domains and General Questions of the UW-QOL According to 54 Patients with oral Cancer Submitted to Surgical Resection. Fortaleza, Ceará, Brazil. 2012-13

	Preoperative	Postoperative	p-value
Importance of domains	n=70	n=64	
Pain	25 (35.7%)*	6 (9.4%)	<0.001**
Mood	8 (11.4%)*	1 (1.6%)	
Anxiety	12 (17.1%)*	1 (1.6%)	
Speech	1 (1.4%)	7 (10.9%)*	
Shoulder function	0 (0.0%)	8 (12.5%)*	
Swallowing	11 (15.7%)	12 (18.8%)	
Chewing	8 (11.4%)	17 (26.6%)	
Other	5 (7.3%)	12 (18.6%)	
(a) Comp. to before diagn.	n=42	n=47	
Much worse	17 (40.5%)*	3 (6.4%)	<0.001**
Somewhat worse	19 (45.2%)*	1 (2.1%)	
About the same	5 (11.9%)*	1 (2.1%)	
Somewhat better	1 (2.4%)	17 (36.2%)*	
Much better	0 (0.0%)	25 (53.2%)*	
(b) Health-related QoL	n=48	n=47	
Very poor	5 (10.4%)	3 (6.4%)	<0.001**
Poor	19 (39.6%)*	1 (2.1%)	
Fair	12 (25.0%)	8 (17.0%)	
Good	9 (18.8%)	23 (48.9%)*	
Very good	3 (6.3%)	12 (25.5%)*	
(c) Overall QoL	n=43	n=47	
Very poor	1 (2.3%)	3 (6.4%)	<0.001
Poor	13 (30.2%)*	0 (0.0%)	
Fair	15 (34.9%)*	6 (12.8%)	
Good	8 (18.6%)	14 (29.8%)	
Very good	5 (11.6%)	14 (29.8%)*	
Outstanding	1 (2.3%)	10 (21.3%)*	

QoL, quality of life; UW-QOL, University of Washington Quality of Life Questionnaire; \* p<0.05, chi-square test; \*\* p<0.001, chi-square test.

(n=23; 46.0%), followed by surgery combined with both radio and chemotherapy (n=14; 28.0%), surgery combined with radiotherapy (n=12; 24.0%) and surgery combined with chemotherapy (n=1; 2.0%).

#### Exposure to risk factors

Four-fifths (81.5%) of our subjects were smokers, 31 of whom (57.4%) had smoked for over 30 years (p<0.001). Five smokers (9.3%) reported smoking up to five cigarettes a day, 14 (25.9%) smoked between six and ten, 13 (24.1%) between eleven and twenty, and 12 (22.2%) over twenty.

More than half of our subjects (n=34; 63.0%) had a history of alcohol consumption. Of these, 2 (3.8%) had consumed alcohol for up to nine years, 3 (5.7%) between 10 and 19.9 years, 6 (11.3%) between 20 and 29.9 years, and 22 (41.5%) for over 30 years. Four alcohol consumers (7.4%) reported drinking once a week, 8 (14.8%) between once and twice a week, 10 (18.5%) between three and five times a week, and 12 (22.2%) on a daily basis. Forty-two

patients (77.8%) had a history of daily sun exposure

### Health Related Quality of life

The comparison between preoperative and postoperative HRQoL scores revealed a significant improvement with regard to pain ( $p=0.003$ ), mood ( $p=0.030$ ) and anxiety ( $p<0.001$ ), whereas pain scores significantly decreased ( $p=0.001$ ). However, no significant difference was observed between preoperative and postoperative HRQoL scores with regard to appearance ( $p=0.274$ ), activity ( $p=0.718$ ), recreation ( $p=0.472$ ), swallowing ( $p=0.106$ ), chewing ( $p=0.250$ ), speech ( $p=0.182$ ), shoulder function ( $p=0.119$ ) or saliva ( $p=0.180$ ) (Table 1).

In the preoperative evaluation, the most important parameters were pain ( $n=25$ ; 35.7%), mood ( $n=8$ ; 11.4%) and anxiety ( $n=12$ ; 17.1%). In the postoperative evaluation, a significantly greater number of patients considered the parameters speech ( $n=7$ ; 10.9%) and shoulder function ( $n=8$ ; 12.5%) to be the most important. Swallowing and chewing were also considered important in absolute figures from both evaluations. Appearance, activity, recreation, taste and saliva were grouped (others) with little relevance in the two phases (Table 2).

HRQoL was significantly better at the time of the postoperative evaluation than one month before the development of the lesion (general question "a"); 17 (36.2%) patients reported feeling somewhat better and 25 (53.2%) much better. The corresponding figures were 1 (2.4%) and 0 (0.0%) in the preoperative evaluation. Likewise, between the two evaluations, the number of patients feeling much worse decreased from 17 (40.5%) to 3 (6.4%), somewhat worse from 19 (45.2%) to 1 (2.1%), and about the same from 5 (11.9%) to 1 (2.1%) ( $p<0.001$ ) (Table 2).

When asked about their HRQoL over the preceding 7 days (general question "b"), significantly more patients responded "poor" ( $n=19$ ; 39.6%) in the preoperative evaluation than in the postoperative evaluation ( $n=1$ ; 2.1%). Likewise, significantly more patients responded "good" ( $n=23$ ; 48.9% vs.  $n=9$ ; 18.8%) or "very good" ( $n=12$ ; 25.5% vs.  $n=3$ ; 6.3%) in the postoperative evaluation ( $p<0.001$ ) (Table 2).

When asked about their overall QoL over the preceding 7 days (general question "c"), significantly fewer patients responded "poor" ( $n=0$ ; 0.0% vs.  $n=13$ ; 30.2%) or "fair" ( $n=6$ ; 12.8% vs.  $n=15$ ; 34.9%) and significantly more patients responded "very good" ( $n=14$ ; 29.8% vs.  $n=5$ ; 11.6%) or "outstanding" ( $n=10$ ; 21.3% vs.  $n=1$ ; 2.3%) in the postoperative evaluation ( $p<0.001$ ) (Table 2).

Patients diagnosed with stage 3 and 4 tumors significantly worsened with regard to swallowing ( $p=0.045$ ) and significantly improved with regard to pain ( $p=0.042$ ), mood ( $p=0.012$ ) and anxiety ( $p=0.043$ ). Pre- and postoperative scores did not differ significantly for patients diagnosed with stage 1 and 2 tumors.

Postoperative pain and anxiety scores improved significantly in both genders. Mood scores increased significantly and taste scores decreased significantly among males ( $p=0.024$  and  $p=0.008$ , respectively). In females, saliva scores decreased significantly, indicating

a loss of QoL ( $p=0.034$ ).

When the patients were segregated by age (<60 years and  $\geq 60$  years), a significant improvement was observed in postoperative pain and anxiety scores in both age groups. Improvement was also significant in mood scores, but only in patients under 60 ( $p=0.034$ ). Shoulder function deteriorated in younger patients ( $p=0.041$ ) while taste scores decreased in older patients ( $p=0.011$ ). The two age groups did not differ significantly with regard to the other domains.

When HRQoL scores were correlated with tumor location, a significant improvement was observed in postoperative pain ( $p=0.017$ ) and appearance ( $p=0.011$ ) scores in patients with lesions on the floor of the mouth and on the lips, respectively. On the other hand, recreation ( $p=0.046$ ) deteriorated in patients with lesions on the lips as did speech ( $p=0.041$ ) and shoulder function ( $p=0.039$ ) in patients with lesions on the floor of the mouth. The other domains revealed no significant differences associated with tumor location.

## Discussion

Every month during the study period, an average of 6 patients with oral cancer were admitted to our institution (Hospital Haroldo Juaçaba, Ceará Cancer Institute). With an average age of  $61.1 \pm 13.9$  years, our sample consisted predominantly of males from the hinterland of Ceará with low levels of schooling. To our knowledge, no other prospective study has been conducted in Northeastern Brazil evaluating HRQoL at different stages of oncological treatment.

Surgical resection is the mainstay of treatment for oral cancer (Chinn and Myers, 2015). According to Borggreven et al., (2007), a thorough evaluation of quality of life before and after surgical resection is necessary to determine the impact of the intervention on the patient's life. The diagnosis of cancer and sequelae from the treatment have a direct impact on physiological, psychological and social function. According to the systematic review of van Nieuwenhuizen et al., (2015) higher scores of pre-treatment physical function and augment in the overall QoL in the 6 months after treatment were associated with increased survival in patients with HNC.

QoL is an increasingly popular parameter, with many applications in medical science (Rogers et al., 2002; Laraway et al., 2012; Ojo et al., 2012), justifying its use in head-and-neck and oral medicine. The use of QoL in patients with HNC facilitates monitoring the patient's condition in general, not only with regard to physiological aspects. A scientific approach to quality of life is essential to pre- and postsurgical evaluations of treatment effectiveness and to understand the clinical course and the impact of the sequelae from the patient's perspective (Boyapati et al., 2013). The UW-QOL is widely used in patients with HNC (Rogers et al., 2002). According to Laraway and Rogers (2012), the UW-QOL is brief, self-administered and multifactorial, while allowing sufficient detail to identify subtle change, and provides questions specific to head-and-neck cancer.

Our prospective analysis of 54 patients submitted to primary surgery revealed significant postoperative changes in HRQoL. Overall, surgery had a negative impact on the domains evaluated in the UW-QOL, but the difference was only significant with regard to taste ( $p=0.001$ ), which was in agreement with previously reported findings in the literature (Rogers et al., 2002; Millsopp et al., 2006; Markkanen-Leppänen et al., 2006; Biazevic et al., 2008; Biazevic et al., 2010; Sharma et al., 2012; Barrios et al., 2015). Markkanen-Leppänen et al., (2006) observed a decrease in appearance, activity, recreation, swallowing, chewing, speech and shoulder function scores 6 months after surgery. According to Borggreven et al., (2007), specific QoL-related domains worsened after treatment, but may return to normal levels after 12 months, with the exception of mouth opening, salivary function and coughing. Thus, in a study by Andrade et al., (2006) involving Brazilian subjects, HRQoL scores were better at 1 year of follow-up than prior to surgery.

The importance of each score was also evaluated by the questionnaire. Rogers et al., (2002) were the first to evaluate the importance of the domains in a longitudinal study on patients diagnosed with oral or oropharyngeal cancers. The authors concluded that the observed associations between specific domain scores and their relative importance could subsidize the development of strategies to improve the quality of life in patients with HNC. Thus, the second version of the UW-QOL included an evaluation of the importance of each score (Laraway and Rogers, 2012). In our study, pain, mood and anxiety were significantly more important before surgery, while speech and shoulder function were significantly more important after surgery. Swallowing (15.9% vs. 18.8%) and chewing (11.6% vs. 26.6%) were frequently mentioned both before and after surgery. The attribution of importance varies greatly among patients, but certain trends are discernible. Overall, swallowing, chewing and speech are considered most important (Rogers et al., 2002; de Andrade et al., 2006; Biazevic et al., 2008; Biazevic et al., 2010; Boyapati et al., 2013), a notion supported by our findings. According to Ganzer et al., (2015) eating is a complex and necessary function commonly affected in HNC. Health care practitioners should understand and talk with patients about the impact on the eating experience (Ganzer et al., 2015).

In the present study, pain scores improved significantly after surgery. Pain was also considered important for HRQoL, especially in the preoperative evaluation. The head-and-neck region is highly susceptible to pain due to extensive innervation and the proximity of anatomical structures (Macfarlane et al., 2012; Lee et al., 2014). In a study evaluating patients with oral cancer prior to and six months after surgery, Rogers et al., (2002) observed improvement in pain scores, which matches our own findings. Most studies evaluating HRQoL in patients with oral or oropharyngeal cancer have reported a similar trend (Markkanen-Leppänen et al., 2006; Biazevic et al., 2008; Biazevic et al., 2010). Although pain in general is not considered the most important domain in the literature, its association with quality of life is well documented (Rogers et al., 2002; de Andrade et al., 2006; Biazevic

et al., 2008; Biazevic et al., 2010; Boyapati et al., 2013). The patients with the lowest overall QoL scores tend to attribute the greatest importance to pain (Rogers et al., 2002). In a preoperative evaluation by Rogers et al., (2002) and Rogers et al., (2012), the priorities identified by the patients included survival, the possibility of cure, longevity and the absence of pain.

In 2000, two emotional domains (mood and anxiety) were added to the UW-QOL (version 4) (Laraway and Rogers, 2012). Although psychological well-being is one of the main components of HRQoL, few researchers have investigated psychological morbidity from oral cancer (Handsichel et al., 2013). Generally, the mood is severely impacted at two specific moments: in the preoperative stage when the diagnosis of cancer is established and in the postoperative stage when the adverse sequelae from surgery become evident. In our study, mood scores improved significantly in the postoperative evaluation ( $p=0.030$ ). In contrast, Biazevic et al., (2008) and Biazevic et al., (2010) reported lower mood scores immediately after surgery and at the 1-year follow-up. Low spirits can directly contribute to depression, which may be evaluated with specific instruments such as the hospital anxiety and depression scale (HADS) (Mochizuki et al., 2009). According to Mochizuki et al., (2009), depression is considered a global indicator of quality of life. In our study, mood was an important domain when comparing pre- and postoperative HRQoL. This finding differs from those in the literature, in which the functions of the stomatognathic system are attributed the greatest importance (Rogers et al., 2002; de Andrade et al., 2006; Biazevic et al., 2008; Biazevic et al., 2010; Boyapati et al., 2013).

Anxiety scores also improved significantly ( $p<0.001$ ) in the postoperative evaluation, matching the results of other studies (Biazevic et al., 2008; Biazevic et al., 2010). Regardless of type and extension, surgery can generate intense anxiety, especially in patients who are unfamiliar with the technicalities of the procedure, have never been submitted to similar interventions, or are apprehensive about the risks involved or the possibility of a cure. However, the importance of anxiety revealed by our pre- and postoperative evaluations is not supported by the literature (Rogers et al., 2002; de Andrade et al., 2006; Biazevic et al., 2008; Biazevic et al., 2010; Boyapati et al., 2013). Mochizuki et al., (2009) believes that HNC patients should be given psychological reassurance prior to surgery to ensure treatment adherence and help patients cope with postoperative sequelae. Some reports indicate that patients suffering with anxiety and depression have a higher occurrence of other problems, such as the impact on appearance and may be more susceptible to pain (Kanas et al., 2012).

Self-perception of quality of life during illness helps monitor patients and understand the impact of the disease and treatment on patients' lives. Social, demographic, psychological and physiological factors may play an important role in this respect. Thus, in answer to general question "b", our patients defined their health-related quality of life as good (48.9%) or very good (25.5%), with a significant difference between pre- and

postoperative levels. Boyapati et al., (2013) reported similar postoperative results for patients submitted to surgery for oral cancer.

In answer to general question “c”, our patients defined their overall quality of life as very good (29.8%) or outstanding (21.3%) with a significant difference between pre- and postoperative levels. Several other authors observed “very good” and “outstanding” as the most frequent responses (Vartanian et al., 2007; Laraway et al., 2012; Boyapati et al., 2013). Other factors such as spiritual health may be related to this positive profile in postsurgical (Mohebbifar et al., 2015).

Patient responses to general question “a” (comparing pre and postoperative HRQoL to that experienced one month before the development of the lesion) were positive in the postoperative evaluation. In the preoperative evaluation, HRQoL was considered somewhat worse (45.2%) or much worse (40.5%), but after surgery it was reported to be much better (53.2%) or somewhat better (36.2%). Few studies have addressed this question. Boyapati et al., (2013) found HRQoL to be about the same or somewhat better after surgery. Further qualitative studies are necessary to shed light on the factors influencing patient responses to the three general questions of the UW-QOL.

Our comparison of specific HRQoL domains with clinicopathological parameters confirmed previous findings and revealed new trends. When clinical tumor stage was correlated with pre- and postoperative HRQoL scores, a significant postoperative improvement was observed for pain ( $p=0.042$ ), mood ( $p=0.012$ ) and anxiety ( $p=0.043$ ). Advanced lesions tend to cause strong pain, justifying the improvement observed after surgery (Macfarlane et al., 2012). According to Manchizuki et al., (2009), and as shown in the present study, anxiety levels of HNC patients are higher prior to surgery. Taste scores decreased, though not significantly, in patients with stage 3 and 4 lesions, possibly because of the high number of lesions in the tongue and floor of the mouth. When resecting aggressive lesions, surgical margins are greater, which compromises physiological functioning (Chinn and Myers, 2015). According to Adnane et al., (2016) 3 factors are directly linked to a better QV: lymphatic involvement, type of surgery and the tumor.

When HRQoL was correlated with age, postoperative shoulder function was found to be more negatively impacted in patients under 60. In older patients, taste scores decreased significantly, possibly because of age-related physiological factors (Laraway et al., 2012).

When HRQoL was correlated with tumor location, a significant postoperative improvement in appearance scores was observed in patients with lip tumors. Visible swelling of the lip mucosa can negatively impact appearance and cause social embarrassment (Millsopp et al., 2006). Han et al., (2014) found a significant relationship between cancer survivors’ QoL and workplace. Shoulder function scores decreased significantly ( $p=0.039$ ) in patients with tumors located on the floor of the mouth. Indeed, malignant tumors on the floor of the mouth and tongue tend to be aggressive and have poor prognoses. Treatment of such tumors usually involves cervical

lymphadenectomy, which in turn limits the movement of the shoulder in the immediate postoperative period (Chinn and Myers, 2015). Further qualitative studies are required to confirm the correlations between QoL and clinicopathological factors observed in the present study.

The UW-QOL was efficient at measuring HRQoL in our sample of patients with oral cancer. Despite being the mainstay of treatment for this condition, surgical resection was associated with a loss of QoL, especially due to sequelae affecting the stomatognathic system. A worsening was observed in specific QoL domains, yet patients classified their postoperative health-related and overall QoL as positive. Qualitative studies and investigations involving other treatment modalities (such as radiotherapy) are necessary to clarify the relationship between HRQoL and socioeconomic and cultural factors.

#### Source of funding

None declared.

#### Conflicts of interest

The authors have no competing interests to report.

#### Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

#### Informed consent

Informed consent was obtained from all individual participants included in the study.

### Acknowledgments

We would like to thank the physicians Dr. Eric Fernandes, Dr. Fernando Porto, Dr. Ricardo Lincoln and Dr. Amanda from the head-and-neck surgery team. We would also like to thank the residents and staff at Hospital Haroldo Juaçaba (Ceará Cancer Institute) for their support and for allowing us access to the clinical service.

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