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Original article

Differences of salivary cortisol levels between long-term and short-term wearers of dento-maxillary prosthesis due to head and neck cancer resection



Moe Kosaka DDS*, Yuka I. Sumita DDS, PhD,
Takafumi Otomaru DDS, PhD, Hisashi Taniguchi DDS, PhD

Department of Maxillofacial Prosthetics, Graduate School of Medical and Dental Sciences, Tokyo Medical and Dental University, 1-5-45 Yushima, Bunkyo-ku, Tokyo 113-8549, Japan

ARTICLE INFO

Article history:

Received 14 November 2012

Received in revised form

2 October 2013

Accepted 15 October 2013

Available online 14 December 2013

Keywords:

Saliva

Cortisol levels

Dento-maxillary prosthesis wearers

ABSTRACT

Purpose: The purpose of this study was to use cortisol awakening response (CAR) to investigate the differences in daily life stress experienced by individuals wearing either a long-term (LT) or a short-term (ST) dento-maxillary prosthesis following head and neck cancer (HNC) resection. Also we used the University of Washington Quality of Life (UW-QOL) version 4 questionnaire to evaluate the differences in quality of life (QOL) scores between ST and LT wearers of a dento-maxillary prosthesis.

Methods: Salivary samples were collected from 11 LT and 10 ST prosthesis wearers on two consecutive days at two time points, immediately after waking up (T0) and 30 min later (T30), by passive drool collection. Cortisol levels were measured using a high sensitivity salivary cortisol enzyme immunoassay kit (Salimetrics, LLC, State College, PA, USA) and CAR (the differences between the cortisol levels at T0 and T30) was compared between LT and ST prosthesis wearers. In addition, both the groups completed the UW-QOL questionnaire and the scores were compared.

Results: A significant difference was observed in CAR between the two groups. CAR of the ST prosthesis wearers was significantly lower compared with that of the LT prosthesis wearers; moreover, the ST prosthesis wearers revealed significantly lower total UW-QOL scores and there were significant differences in appearance, activity, recreation, speech, and anxiety.

Conclusion: Within the limitations of this study, the findings suggest that individuals wearing ST dento-maxillary prostheses following HNC resection experience some sort of daily life stress and complicated socio-demographic factors may influence their QOL.

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1. Introduction

Following surgical treatment for head and neck cancer (HNC), patients can experience facial disfigurement and severe

functional impairment of mastication, deglutition, and speech. Moreover, evidence to date suggests that patients with HNC often struggle with postsurgical stressors and psychosocial issues, including fear of cancer recurrence, depression, and anxiety [1]. Thus, questionnaires have been

* Corresponding author. Tel.: +81 3 5803 5556; fax: +81 3 5803 5556.

E-mail address: kosamfp@tmd.ac.jp (M. Kosaka).

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<http://dx.doi.org/10.1016/j.jpor.2013.10.001>

used to investigate subjective assessments of stress, including psychosocial factors, in patients with HNC [2–5]. However, to the best of our knowledge, objective stress assessments of such patients have not been sufficiently investigated.

Stress responses are widely characterized as involving two main systems: the sympathetic-adrenal-medullary axis and the hypothalamic-pituitary-adrenal (HPA) axis. The former is primarily triggered by acute stressors, whereas the latter is involved in the long-term effects of both acute and chronic stress. Cortisol is regulated by a negative feedback system and can serve as an index of HPA axis activity. In fact, salivary cortisol has been reported to be a useful objective marker and has been used for stress assessments in the measurement of individual variations or comparisons of groups matched for specific characteristics such as age and physical conditions [6–11]. In addition, high correlations between serum and salivary cortisol levels have been reported [12,13]. A sharp increase has been observed in individuals' cortisol levels 30–45 min after waking up and has been termed the cortisol awakening response (CAR). CAR has been analyzed using several different approaches, such as simple change in levels between waking and 30–45 min later, and area under the curve imputed from repeated samples. Several studies have investigated this response [14–19], and variations in CAR could provide valuable information about the psychosocial factors operating in daily life. Thus, morning salivary cortisol levels can be a marker for objective daily life stress assessments in patients with HNC.

A dento-maxillary prosthesis is often recommended for the rehabilitation of functional impairment and improvement of appearance following HNC resection. In mandibulectomy patients, not only prosthetic treatment but also proper surgical reconstruction is important for the oral rehabilitation [20]. Many functional evaluations after the delivery of the dento-maxillary prosthesis have demonstrated enhancement of oral functions [21,22] and quality of life (QOL) [23]. However, few studies have investigated the relation between salivary cortisol levels and prosthetic treatments. Kohno et al. reported that salivary cortisol levels decreased after uncomfortable removable partial dentures were adjusted [24], and Ugawa et al. reported that following maxillectomy, patients with HNC experienced psychological stress during speech, even if their prostheses afforded functional improvement [25]. However, daily life stress and salivary cortisol levels in the morning have not been investigated in patients with HNC wearing a dento-maxillary prosthesis. The following were the purposes of this study: (1) to use CAR to investigate the differences in daily life stress experienced by individuals wearing either a long-term (LT) or a short-term (ST) dento-maxillary prosthesis following HNC resection; and (2) to use the University of Washington Quality of Life (UW-QOL) version 4 questionnaire to evaluate the differences in QOL scores between both the prosthesis wearer groups.

In this study, we tested the following null hypotheses: (1) CAR do not differ between ST and LT wearers of a dento-maxillary prosthesis in HNC patients and (2) QOL scores do not differ between ST and LT wearers of a dento-maxillary prosthesis.

2. Materials and methods

2.1. Subjects

The following were the inclusion criteria for the LT prosthesis wearers: (1) they had undergone mandibulectomy because of HNC; (2) they had no complaints with the prosthesis; (3) there was no need for adjustment of the prosthesis; and (4) they had at least three months' experience wearing the prosthesis. The following were the inclusion criteria for the ST prosthesis wearers: (1) they had undergone mandibulectomy because of HNC; (2) they needed adjustment of the prosthesis; and (3) they had less than three months' experience wearing the prosthesis. All the ST prosthesis wearers received their first dento-maxillary prosthesis following HNC resection. Further, the following were the exclusion criteria for both the patient groups: (1) habitual smoking; (2) use of oral contraceptives; (3) presence of severe periodontitis; (4) presence of infectious diseases such as viral hepatitis; (5) age over 80 years; (6) scores exceeding 65 on the State-Trait Anxiety Inventory-Form JYZ (STAI JYZ) questionnaire; (7) inability to speak, read, or understand Japanese; (8) discontinuity of mandibular bone; and (9) existence of a bulky flap on the reconstruction part. All the patients received a dento-maxillary prosthesis following HNC resection from the Department of Maxillofacial Prosthetics, Tokyo Medical and Dental University Hospital Faculty of Dentistry.

On the basis of these criteria, 21 subjects (11 LT prosthesis wearers and 10 ST prosthesis wearers) were recruited from November 2011 to July 2012, who participated in the study. Table 1 presents the characteristics of all the participants.

This study was approved by the Ethics Committee of the Faculty of Dentistry, Tokyo Medical and Dental University (Approval No. 645). Written informed consent was obtained from all the patients prior to participation.

2.2. STAI JYZ questionnaire

To exclude severely depressed subjects, we selected the STAI JYZ questionnaire [26] for psychological screening. This questionnaire is a 40-item measure of the intensity of the feeling of anxiety and distinguishes between state anxiety and trait anxiety. All subjects were requested to complete the STAI JYZ questionnaire, and scores of state anxiety and trait anxiety were calculated.

2.3. Saliva sampling

Self-reporting sheets were prepared to monitor the saliva sampling conditions, according to the reports from previous studies [27–30]. With regard to the self-reporting sheets, data were collected regarding the time of saliva sampling, time of waking up, bedtime, sleep quality (good, fairly good, could not sleep), use/nonuse of an alarm clock, time and dose of any medication taken, time and amount of alcohol consumption, and oral conditions.

Each subject received a sampling kit containing instructions, four plastic Falcon tubes ($\varnothing 30$ mm \times 115 mm),

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