学 位 論 文 の 要 旨

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学　位　論　文　名	Effect of Body Mass Index on Post-treatment Oral Function in Patients with Oral Cancer: A Cross-sectional Study
発　表　雑　誌　名 （巻，初頁～終頁，年）	Scientific Reports (**14**, 21869, 2024)
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論 文 内 容 の 要 旨

INTRODUCTION

Numerous studies have reported the effects of body mass index (BMI) on cancer treatment outcomes. Low BMI has been reported to decrease response rates to treatment and survival rates in patients receiving lung cancer treatment and decrease the survival rate of patients receiving liver cancer treatment. In contrast, high BMI increases complication rates in the treatment of colorectal and esophageal cancers. Hence, too high or too low BMI may be a factor influencing cancer treatment outcomes.

The influence of BMI on oral cancer treatment has been reported previously. Low BMI (< 18.5 kg/m^2) has been identified as an independent factor, along with low albumin levels and low prognostic nutritional index, for reducing overall survival after treatment in patients with oral cancer. Sarcopenia, a loss of muscle mass that is strongly associated with BMI, has also been reported as a risk factor for complications and poor survival rates in oral cancer treatment. Additionally, sarcopenia is associated with high complication rates during cancer treatment, increased adverse event rates in chemotherapy, and lower success rates in reconstructive surgery. Nonetheless, a meta-analysis examining the relevance of BMI in the treatment of head and neck cancers, including oral cancer, revealed some paradoxes. According to the meta-analysis, overweight (BMI: 25–30 kg/ m^2) or underweight (BMI: < 18.5 kg/m^2) shows decreased survival rate compared with normal weight (BMI: 18.5–25 kg/m^2), while the risk of decreased survival rate loses its significance when BMI exceeds 30 kg/m^2. This suggests the presence of other unknown factors in the association between BMI and survival rate. Most previous studies have reported on oral cancer survival rate and BMI. In healthy adults, higher oral function is reported to be associated with higher BMI, and in patients with gastric cancer, oral function declines with

a decrease in BMI. However, no reports have examined the association between comprehensive oral function and BMI in patients with oral cancer. Therefore, we hypothesized that the higher the oral function after oral cancer treatment, the higher the BMI. In addition, survival is not necessarily the primary treatment outcome for older patients with oral cancer in a super-aged society such as Japan, and oral function assessment and quality of life after oral cancer treatment are crucial. Therefore, this study aimed to examine the impact of BMI on oral function after oral cancer treatment and its relevance.

MATERIALS AND METHODS

This cross-sectional study collected background data and evaluated the oral function (microorganisms, oral dryness, occlusal force, tongue pressure, masticatory function and eating assessment tool [EAT-10]) of 102 patients from September 2019 to December 2023. The BMI was used for the subjective assessment of dysfunction in oral cancer patients. Also, Matsuda-Kanno classification was used for the objective assessment. The Shapiro–Wilk test was used to confirm normality of the data. Continuous data are described as mean and standard deviation, and categorical data as number and percentages. Pearson's correlation coefficient was calculated to determine the association between continuous data. The three BMI groups were analyzed using one-way analysis of variance and the Jonckheere–Terpstra test. Multiple linear regression analysis (forced entry method) was conducted as a multivariate analysis, considering confounding factors. The study protocol was approved by the Research Ethics Committee of Shimane University (No. 4041).

RESULTS AND DISCUSSION

The mean age was 69.6 years (standard deviation 13.6). The mean pre-treatment BMI was 21.5 kg/m^2 (standard deviation 4.0), and the mean rate of change after treatment was -8.1% (7.2). The primary tumor sites were tongue and gingiva in 86 patients (84.3%); 64 patients (62.7%) had advanced cancer at clinical stages III and IV.

Pre-treatment BMI showed a significant relationship with postoperative oral function, especially tongue pressure ($P = 0.01$). Although there were no significant differences in the mean values among the groups, the Jonckheere–Terpstra test showed a significant trend toward a stepwise increase in tongue pressure in each BMI group ($P = 0.03$).

The main finding of this study was the association between pre-treatment BMI and postoperative tongue pressure. The components contributing to tongue pressure include the intrinsic tongue muscles (transverse and longitudinal muscles), extrinsic tongue muscles (genioglossus, hyoglossus, styloglossus, and palatoglossus muscles), nerves (hypoglossal nerve), tongue volume, and palate morphology. Surgical resection of muscles and nerves leads to a decreased tongue volume and range of motion, resulting in decreased tongue pressure. Radiation

therapy and chemotherapy also contribute to functional decline, although to a smaller magnitude than organic morphological changes caused by tongue resection. Reconstructive surgery has long been used as a countermeasure against the development of organic defects in the tongue. It has also shown esthetic and functional benefits, with many reports of tongue function restoration due to improvements in surgical equipment and techniques. In addition to treatment-related factors, individual patient factors also influence tongue pressure. Treatment with palatal augmentation prostheses is effective because the volume occupied by the tongue in relation to the oral cavity is important for increasing tongue pressure. During swallowing, the volume of the tongue occupying the oral cavity and palate height are important factors. Since the analysis in this study was adjusted for the effects of treatment-related factors such as surgical site, reconstructive surgery, and neck dissection, individual patient factors may have an independent effect on postoperative tongue pressure. It is important to note that while the palatal height is a constant patient factor, BMI is a variable patient factor that can be addressed.

Although this study revealed the relationship between pre-treatment BMI and post-treatment tongue pressure, the results are consistent with and can be explained by existing literature. First, tongue thickness and BMI have been reported to be positively correlated. In particular, since the posterior part of the tongue has more adipose tissue than the anterior part, having a higher BMI could be advantageous in increasing tongue pressure. Furthermore, since tongue thickness has been reported to be directly related to tongue pressure, it is reasonable to assume that a higher BMI will produce a higher tongue pressure after oral cancer treatment. Patients with oral cancer already have poor oral function and nutritional status before treatment. In particular, a strong association between BMI and sarcopenia has been reported, and older patients with oral cancer may require treatment when sarcopenia and low BMI coexist. Sarcopenia is another factor that contributes to decreased tongue pressure. Therefore, attention should be paid to the decrease in post-treatment tongue pressure in patients falling into the low BMI category according to the world health organization criteria. Moreover, enhanced nutritional therapy is advisable before treatment initiation.

CONCLUSION

Pre-treatment BMI was significantly associated with post-treatment tongue pressure. As BMI is a variable factor that can be controlled by nutritional therapy even before treatment, the results suggest that early nutritional intervention and weight control may be important in oral cancer treatment.