



# Characteristic multimodal imaging of palatal follicular lymphoma: a case report on effectiveness of CT, diffusion-weighted MR imaging and intraoral ultrasonography

Yoshiyuki Minami<sup>1</sup> · Ruri Ogawa<sup>1</sup> · Yoriaki Kanri<sup>2</sup> · Yasuhito Tezuka<sup>1</sup> · Yasuo Okada<sup>2</sup> · Ichiro Ogura<sup>1</sup>

Received: 3 May 2022 / Accepted: 14 July 2022 / Published online: 1 August 2022  
© The Author(s) under exclusive licence to Japanese Society for Oral and Maxillofacial Radiology 2022

## Abstract

Oral lymphomas are relatively uncommon. Follicular lymphoma is the second most common subtype of non-Hodgkin lymphoma. We report characteristic multimodal imaging of palatal follicular lymphoma, especially CT, diffusion-weighted MR imaging (DWI) and intraoral ultrasonography. A 67-year-old woman presented with swelling on the right side of the palate within 2 months. On clinical examination, an approximately 35 × 20 mm mass lesion with elastic soft was found to overlay the right side of the palate. Contrast-enhanced CT image showed a mass with homogeneous enhancement on the right side of the palate, and bone tissue algorithm CT showed focal erosion of the right posterior maxilla. Regarding MR imaging, on T1-weighted image, the mass showed low signal intensity and homogeneous enhancement, and T2-weighted and STIR images revealed intermediate and high signal intensity, respectively. Furthermore, DWI and apparent diffusion coefficient (ADC) map showed high and low signal intensity, respectively. ADC value of the mass was  $0.60 \times 10^{-3} \text{ mm}^2 \text{ s}^{-1}$ . On intraoral ultrasonography, the mass showed clear boundary, hypoechoic echogenicity, homogeneous internal architecture, vascular signals using color Doppler imaging and heterogeneous hard using strain elastography. A partial biopsy of the palatal region was performed. Histopathological diagnosis was follicular lymphoma. This case suggests that multimodal imaging, especially CT, DWI with ADC map and intraoral ultrasonography with color Doppler imaging and strain elastography, could be effective for evaluating palatal lesions.

**Keywords** Apparent diffusion coefficient · Diffusion-weighted magnetic resonance imaging · Strain elastography · Ultrasonography · Head and neck neoplasms

## Introduction

Lymphomas in the oral and oropharyngeal regions are relatively uncommon, and their diagnosis is challenging and complex due to the myriad histopathological subtypes. The most frequent subtypes in each group were diffuse large B-cell lymphomas [1]. Lymphomas are a heterogeneous group of malignant diseases characterized by the

proliferation of malignant lymphoid cells or their precursors [2]. Follicular lymphoma is the second most common subtype of non-Hodgkin lymphoma [3].

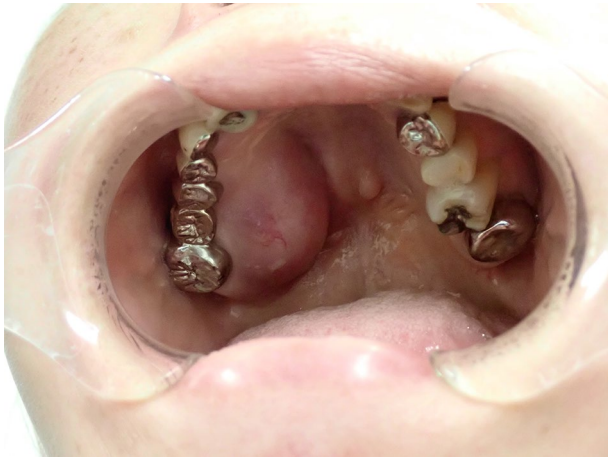
Various imaging modalities, such as CT, MR imaging and FDG-PET/CT, have been used to assess palatal lesions [4]. Diffusion-weighted MR imaging (DWI) with apparent diffusion coefficient (ADC) maps is not only important for the diagnosis of oral and maxillofacial lesions but also for the differentiation of benign lesions from malignant lesions [5, 6]. Furthermore, the ADC value derived from DWI could be useful for the characterization of benign and malignant palatal tumors [7].

Recently, strain elastography using intraoral ultrasonography has been applied for pre-operative planning of tongue carcinoma [8] and palatal tumors [9]. However, no results were found for multimodal imaging of palatal follicular lymphoma using PubMed. We report characteristic multimodal

✉ Ichiro Ogura  
ogura@ngt.ndu.ac.jp

<sup>1</sup> Department of Oral and Maxillofacial Radiology, The Nippon Dental University School of Life Dentistry at Niigata, 1-8 Hamaura-cho, Chuo-ku, Niigata, Niigata 951-8580, Japan

<sup>2</sup> Department of Pathology, The Nippon Dental University School of Life Dentistry at Niigata, 1-8 Hamaura-cho, Chuo-ku, Niigata, Niigata 951-8580, Japan



**Fig. 1** Intraoral view shows an approximately 35×20 mm mass lesion with elastic soft was found to overlay the right side of the palate

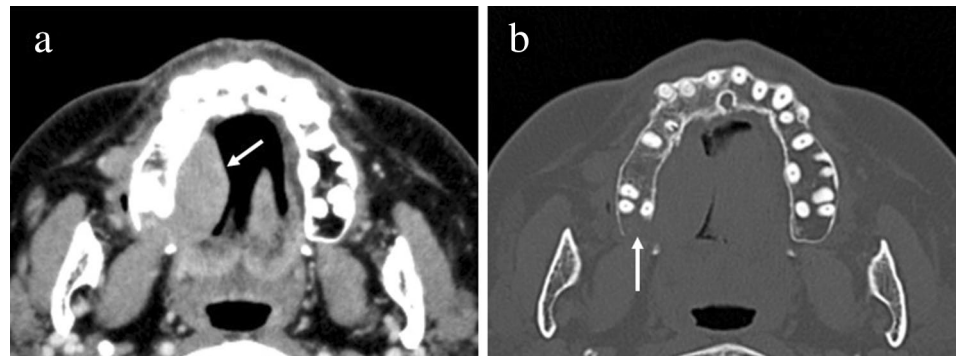
imaging of palatal follicular lymphoma, especially CT, DWI and intraoral ultrasonography.

## Case report

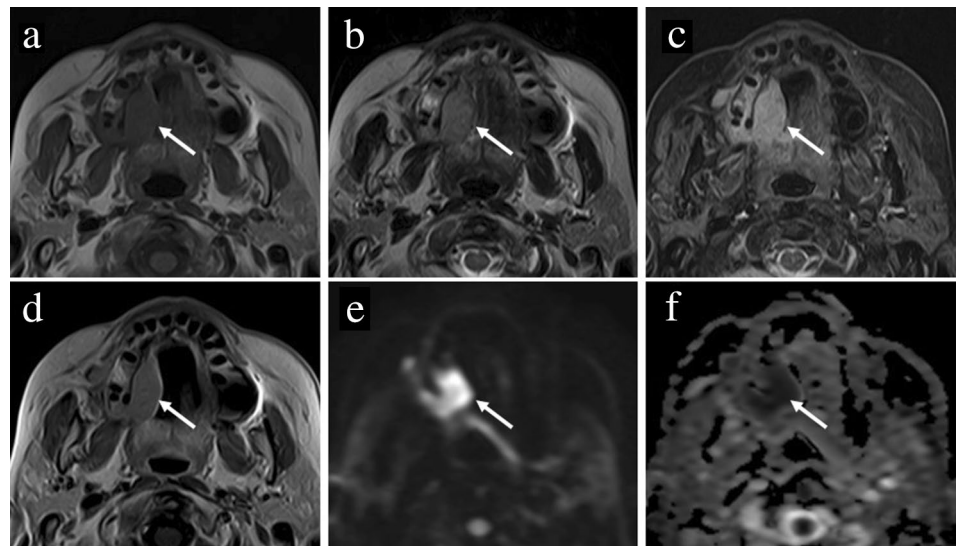
A 67-year-old woman presented with swelling on the right side of the palate within 2 months. On clinical examination, an approximately 35×20 mm mass lesion with elastic soft was found to overlay the right side of the palate (Fig. 1).

Contrast-enhanced CT image showed a mass with homogeneous enhancement on the right side of the palate (Fig. 2a), and bone tissue algorithm CT showed focal erosion of the right posterior maxilla (Fig. 2b). Regarding MR imaging, on T1-weighted image, the mass showed low signal intensity (Fig. 3a) and homogeneous enhancement (Fig. 3d), and T2-weighted and STIR images revealed intermediate (Fig. 3b) and high (Fig. 3c) signal intensity, respectively. Furthermore, DWI and ADC maps showed high (Fig. 3e) and low (Fig. 3f) signal intensity, respectively. ADC value of the mass was  $0.60 \times 10^{-3} \text{ mm}^2 \text{ s}^{-1}$ . On intraoral ultrasonography, the mass showed clear boundary, hypoechoic echogenicity, homogeneous internal architecture, vascular signals using color Doppler imaging (Fig. 4a) and heterogeneous hard using strain elastography (Fig. 4b).

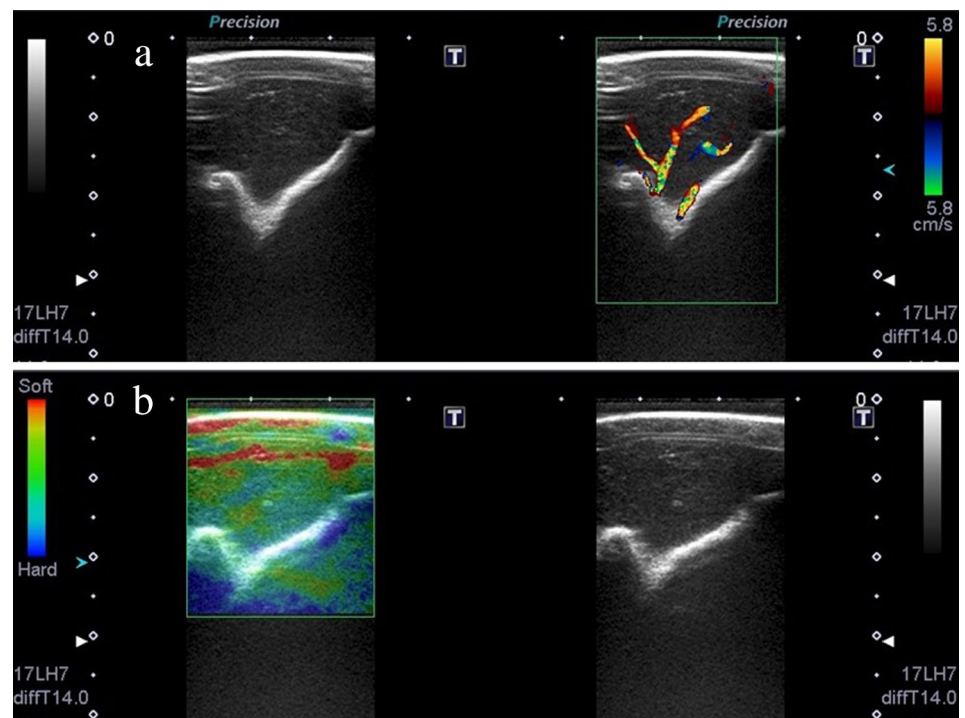
**Fig. 2** Contrast-enhanced CT image showed a mass with homogeneous enhancement on the right side of the palate (a, arrow), and bone tissue algorithm CT showed focal erosion of the right posterior maxilla (b, arrow)



**Fig. 3** On T1-weighted image, the mass showed low signal intensity (a, arrow) and homogeneous enhancement (d, arrow), and T2-weighted and STIR images revealed intermediate (b, arrow) and high (c, arrow) signal intensity, respectively. DWI and ADC maps showed high (e, arrow) and low (f, arrow) signal intensity, respectively



**Fig. 4** On intraoral ultrasonography, the tumor showed clear boundary, hypoechoic echogenicity, homogeneous internal architecture, vascular signals using color Doppler imaging (a) and heterogeneous hard using strain elastography (b)



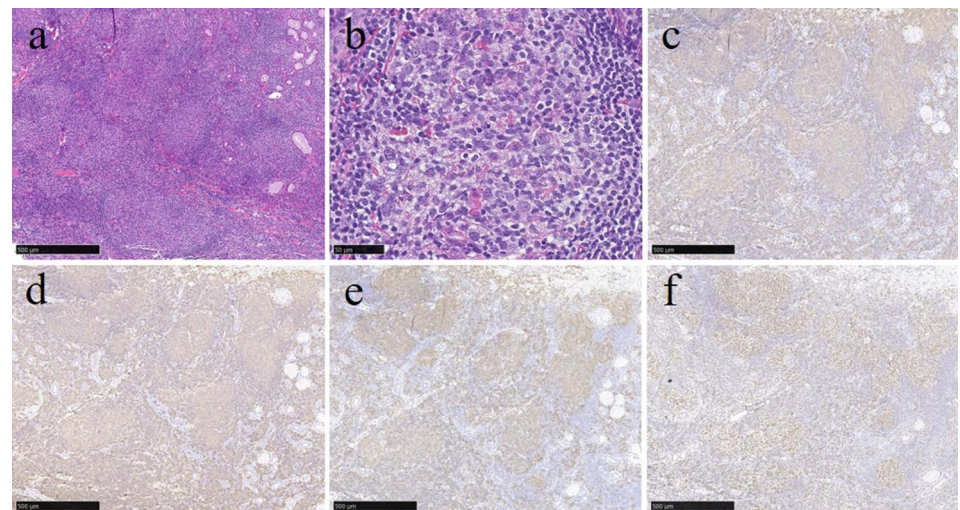
A partial biopsy of the palatal region was performed. Histopathological examination revealed hyperplasia of the neoplastic follicles (Fig. 5a). The centroblast-like large atypical cells (large non-cleaved cells) and the centrocyte-like small to medium-sized atypical cells (small cleaved cells) were observed in the neoplastic follicle (Fig. 5b). Immunohistochemical staining showed that the tumor cells were positive for the B cell markers CD20 and CD79 $\alpha$  (Fig. 5cd), but negative for the T cell markers CD3 $\epsilon$  and CD45RO. In addition, the tumor cells were positive for the germinal center markers Bcl-6 and CD10 (Fig. 5ef). Histopathological diagnosis was follicular lymphoma, grade 2. The patient was transferred to

another hospital for chemotherapy. This study was approved by the Ethics Committee (ECNG-R-400).

## Discussion

de Arruda et al. [1] indicated that oral lymphomas are relatively uncommon, mostly affecting individuals aged 60–69 years, and the most commonly involved sites were the palate (26.3%), mandible (13%), and maxilla (10.5%). Tseng et al. [2] showed that the most frequent site was the gingiva, followed by palate, and the most frequent symptoms were

**Fig. 5** Microscopic findings of the biopsy specimen. The follicular-like nodules, i.e., neoplastic follicular hyperplasia and a few palatine gland acini are observed (a). The centroblast-like large atypical cells (large non-cleaved cells) and the centrocyte-like small to medium-sized atypical cells (small cleaved cells) are observed in the neoplastic follicle (b). The tumor cells are immunohistochemically positive for CD20 (c), CD79 $\alpha$  (d), Bcl-6 (e), and CD10 (f). Scale bar, a; 500  $\mu$ m, b; 50  $\mu$ m, c-f; 500  $\mu$ m



swelling. Wagner et al. [3] showed that although uncommon, malt lymphoma was the most frequently reported subtype, followed by follicular lymphoma of the oral cavity, the palate was affected in a high proportion of cases, the most usual clinical presentation was an asymptomatic swelling, and cases were more common in elderly individuals. We reported follicular lymphoma with swelling on the right side of the palate in a 67-year-old woman, and considered that most studies included in our case report showed similarities regarding older patients, palate and swelling.

Various imaging modalities, such as CT, MR imaging and FDG-PET/CT, have been used to assess palatal lesions [4]. Our case with palatal follicular lymphoma showed that a contrast-enhanced CT image showed a mass with homogeneous enhancement on the right side of the palate, and bone tissue algorithm CT showed focal erosion of the right posterior maxilla. Regarding MR imaging, on T1-weighted image, the mass showed low signal intensity and homogeneous enhancement, and T2-weighted and STIR images revealed intermediate and high signal intensity, respectively.

DWI is not only important for the diagnosis of oral and maxillofacial lesions but also for the differentiation of benign lesions from malignant lesions, and ADC value derived from DWI could be useful for the characterization of benign and malignant palatal tumors [5–7]. Our case with palatal follicular lymphoma showed that DWI and ADC map showed high and low signal intensity, respectively. In our case, the ADC value of the tumor was  $0.60 \times 10^{-3} \text{ mm}^2 \text{ s}^{-1}$ . Asai et al. [4] indicated that lymphomas ( $0.48 \times 10^{-3} \text{ mm}^2 \text{ s}^{-1}$ ) had significantly lower ADC values compared with malignant salivary gland tumors ( $1.09 \times 10^{-3} \text{ mm}^2 \text{ s}^{-1}$ ), and the difference in ADC values may be related to the greater cellularity of lymphoma. Maeda et al. [10] reported that the ADC value of lymphoma ( $0.65 \times 10^{-3} \text{ mm}^2 \text{ s}^{-1}$ ) was significantly lower than that of squamous cell carcinoma ( $0.96 \times 10^{-3} \text{ mm}^2 \text{ s}^{-1}$ ) of the head and neck. Gencturk et al. [11] showed that the ADC value of lymphoma ( $0.61 \times 10^{-3} \text{ mm}^2 \text{ s}^{-1}$ ) was lower than that of adenoid cystic carcinoma ( $1.28 \times 10^{-3} \text{ mm}^2 \text{ s}^{-1}$ ) in sinonasal neoplasms. We consider that ADC value could be effective for the differentiation of lymphoma from other malignant tumors.

Recently, strain elastography using intraoral ultrasonography has been applied for pre-operative planning of tongue carcinoma [8] and palatal tumors [9]. Our case with palatal follicular lymphoma showed that the tumor on ultrasonography showed clear boundary, hypoechoic echogenicity, homogeneous internal architecture, vascular signals using color Doppler imaging and heterogeneous hard using strain elastography. We conclude that intraoral ultrasonography with color Doppler imaging and strain elastography can be effective for evaluating palatal lesions.

In conclusion, we reported characteristic multimodal imaging of palatal follicular lymphoma. This case suggests

that multimodal imaging, especially CT, DWI with ADC map and intraoral ultrasonography with color Doppler imaging and strain elastography, could be effective for evaluating palatal lesions.

## Declarations

**Conflict of interest** Yoshiyuki Minami, Ruri Ogawa, Yoriaki Kanri, Yasuhiro Tezuka, Yasuo Okada and Ichiro Ogura declare that they have no conflict of interest.

**Human rights statement** All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008 (5).

**Informed consent** Informed consent was obtained from all patients for being included in the study.

## References

1. de Arruda JAA, Schuch LF, Conte Neto N, de Souza LL, Rodrigues-Fernandes CI, Abreu LG, et al. Oral and oropharyngeal lymphomas: a multi-institutional collaborative study. *J Oral Pathol Med.* 2021;50:603–12.
2. Tseng CH, Wang WC, Chen CY, Hsu HJ, Chen YK. Clinical manifestations of oral lymphomas - retrospective study of 15 cases in a Taiwanese population and a review of 592 cases from the literature. *J Formos Med Assoc.* 2021;120:361–70.
3. Wagner VP, Rodrigues-Fernandes CI, Carvalho MVR, Dos Santos JN, Barra MB, Hunter KD, et al. Mantle cell lymphoma, malt lymphoma, small lymphocytic lymphoma, and follicular lymphoma of the oral cavity: an update. *J Oral Pathol Med.* 2021;50:622–30.
4. Asai S, Nakamura S, Kuribayashi A, Sakamoto J, Yoshino N, Kurabayashi T. Effective combination of 3 imaging modalities in differentiating between malignant and benign palatal lesions. *Oral Surg Oral Med Oral Pathol Oral Radiol.* 2021;131:256–64.
5. Ogura I, Sasaki Y, Kameta A, Sue M, Oda T. Diffusion-weighted imaging in the oral and maxillofacial region: usefulness of apparent diffusion coefficient maps and maximum intensity projection for characterization of normal structures and lesions. *Pol J Radiol.* 2017;82:571–7.
6. Oda T, Sue M, Sasaki Y, Ogura I. Diffusion-weighted magnetic resonance imaging in oral and maxillofacial lesions: preliminary study on diagnostic ability of apparent diffusion coefficient maps. *Oral Radiol.* 2018;34:224–8.
7. Oohashi M, Mizuhashi F, Sugawara Y, Saegusa H, Ogura I. Diffusion-weighted magnetic resonance imaging in the palatal tumors: usefulness of apparent diffusion coefficient value for characterization of benign and malignant tumors. *Oral Sci Int.* 2020;17:142–6.
8. Ogura I, Sasaki Y, Sue M, Oda T. Strain elastography of tongue carcinoma using intraoral ultrasonography: a preliminary study to characterize normal tissues and lesions. *Imaging Sci Dent.* 2018;48:45–9.
9. Ogura I, Toshima H, Akashiba T, Ono J, Okada Y. Strain elastography of palatal tumors in conjunction with intraoral ultrasonography, computed tomography, and magnetic resonance imaging: 2 case reports. *Imaging Sci Dent.* 2020;50:73–9.
10. Maeda M, Kato H, Sakuma H, Maier SE, Takeda K. Usefulness of the apparent diffusion coefficient in line scan diffusion-weighted

- imaging for distinguishing squamous cell carcinomas and malignant lymphomas of the head and neck. *Am J Neuroradiol.* 2005;26:1186–92.
11. Gencturk M, Ozturk K, Caicedo-Granados E, Li F, Cayci Z. Application of diffusion-weighted MR imaging with ADC measurement for distinguishing between the histopathological types of sinonasal neoplasms. *Clin Imaging.* 2019;55:76–82.

Springer Nature or its licensor holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.