A 17-year-old male patient was referred for the extraction of impacted mesiodens and canine (#23) before orthodontic treatment. In the radiologic examination, an ovoid-shape radiolucent lesion was found with well-defined hyperostotic rim involved the teeth in left maxillary area. After biopsy examination the lesion was diagnosed as glandular odontogenic cyst (GOC) differentially from non-odontogenic cysts, i.e., nasopalatine duct cyst. In the immunohistochemistry the cyst epithelium was frequently positive for PCNA, clearly positive for amylloblastin, slightly positive for β-catenin, but rarely positive for amelogenin and cytokeratin 7. Mucin and PRP were positive in the secretory cells of the cyst epithelium, On the other hand, TNFα was strongly positive in the macrophages infiltrated into the mucin-filled cyst lumen, and CD68 and CD31 were positive in the mucin-filled macrophages. These findings may indicate that the glandular elements are derived from hamartomatous secretory organ and that this odontogenic cyst is arisen from the embryonal rests of enamel epithelium, which has a potential to be differentiated into not only the enamel organ but also the secretory gland. Taken together, we assumed that the present case of GOC was originated from the odontogenic epithelium of impacted teeth, but showed the cytodifferentiation of glandular cells.

Key words: Glandular Odontogenic Cyst, Glandular Differentiation

I. Introduction

The glandular odontogenic cyst (GOC) is a rare odontogenic cyst included in the WHO classification as histologic typing of odontogenic tumors under the terminology of “glandular odontogenic cyst” or “sialo-odontogenic cyst”. GOC is also known as an uncommon jaw bone cyst of odontogenic origin with multicocular mandibular cystic lesions. That was similar to Botryoid odontogenic cyst (BOC) with a glandular element significantly, but also speculated the possibility of intraoral salivary gland origin of these cysts.

Clinically, the most common site of occurrence is mandibular anterior region, presenting as an asymptomatic slow growing swelling. GOC occurs mostly in the middle age and has a slight female predilection. In this article, the clinical, radiological, and histopathological
features of GOC are presented and discussed with the review of 32 cases of GOC hitherto reported.

II. Case Report

A 17-year-old male patient was referred for the extraction of impacted mesiodens and canine (#23) in order to receive orthodontic treatment. The patient was asymptomatic and no medical reports were mentioned except heavy drinking almost twice a week. In the intraoral examination the overlying mucosa was normal both in color and appearance, and a canine was not erupted. There was no sensory abnormality or any other obvious signs of infection.

In the radiologic examination, an ovoid-shape radiolucent lesion was bordered by well-defined hyperostotic rim involved the crown area of impacted mesiodens and canine (#23) in left maxillary area (Fig. 1A). Cone-Beam Computed Tomogram (CT) scan disclosed the three dimensional location of the lesion and the impacted teeth. There were 30 x 25 x 30mm well-defined radiolucent lesion involving the horizontally impacted teeth (Fig. 1B). The mesiodens was located at palatal side, and the canine was at labial side (Fig. 1C).

The removed specimen showed a thick cyst wall in multi-nodular shape, and its microsection on the bisected

Fig. 1. Radiological observation by pantomogram and Cone-Beam Computed Tomography (CT). A: Panoramic radiograph showed an ovoid-shape radiolucent lesion bordered by well-defined hyperostotic rim (arrows) involved impacted mesiodens and canine (#23) in left maxillary area, B: Cone-Beam CT scan showed the three dimensional location, mesiodens in palatal side and canine in labial side (12-16 images), There were 30 x 25 x 30mm well-defined lesion (9-16 images) involving mesiodens and canine impacted horizontally (C), C1: Lingual view of the impacted teeth, C2: Labial view of the impacted teeth.
Fig. 2. Photomicrographs of GOC. a: Low magnification of whole microsection, noted the multilocular cyst spaces (arrows). b-g: Hematoxylin and eosin stain. b-d: The cyst epithelium was thin and consisted of secretory epithelial cells with glandular structure (arrows). e: The lining epithelium was basically stratified type, and its superficial layer cells were differentiated into columnar secretory cells. f-g: Mucin-filled macrophages (arrows) were infiltrated. h: Mucicarmine stain, h1-h2: The cilia (arrows) were well demarcated in the luminal surface of the secretory cells, h3: The glandular cell area was also stained red. i: PAS stain, i1-i2: The secretory cells and mucin-filled macrophages (arrows) were stained pink, j-s: Immunohistochemical staining. j: PCNA, frequently positive in the cyst epithelium, k: Ameloblastin, was clearly positive in the cyst epithelium, l: Amelogenin, rarely positive in the cyst epithelium, m: Cytokeratin 7, rarely positive in the cyst epithelium, n: β-catenin, slightly positive in the cyst epithelium, o: Mucin, positive in the secretory cells of the cyst epithelium, p: PRP, weakly positive in the cyst epithelium, q: TNFα, strongly positive in the macrophages (arrows) infiltrated into the mucin-filled cyst lumen, r: CD68, positive in the mucin-filled macrophages (arrows), s: CD31, positive in the mucin-filled macrophages (arrows).

surface showed a narrow cyst lumen lined by thin epithelium, frequently forming microcysts (Fig. 2a). The cyst wall was composed of thick collagenous fibrous tissue, and its cyst epithelium showed tall columnar
secretory cells likely mucin-producing Goblet cells, also admixed with glandular structure in crypt area (Fig. 2b-g). Some epithelial cells had cilia in the luminal surface, which were clearly defined by mucicarmine stain. The mucous materials found in the Goblet cells and in the lumen of glandular structure were stained red in mucicarmine stain and pink in PAS stain (Fig. 2h,i). Taken together, with the radiological and histological observations the cyst lesion was diagnosed as glandular odontogenic cyst (GOC).

The cyst epithelium was thin and consisted of secretory epithelial cells with glandular structure (Fig. 2c). The lining epithelium was basically stratified type, and its superficial layer cells were differentiated into columnar secretory cells, which had cilia in the luminal side (Fig. 2e). Many mucin-filled macrophages were also infiltrated into the cyst lumen (Fig. 2g). Both the secretory cells and mucin-filled macrophages were stained pink in PAS stain (Fig. 2i).

In the immunohistochemistry PCNA was frequently positive in the cyst epithelium, and ameloblastin was clearly positive in the cyst epithelium, while amelogenein and cytokeratin 7 were rarely positive in the cyst epithelium, β-catenin was slightly positive in the cyst epithelium. Mucin and proline rich protein (PRP) were positive in the secretory cells of the cyst epithelium. On the other hand, TNFα was strongly positive in the macrophages infiltrated into the mucin-filled cyst lumen, and CD68 and CD31 were also positive in the mucin-filled macrophages (Fig. 2j-s).

### III. Discussion

There is a need of differential diagnosis between GOC and nasopalatine duct cyst of non-odontogenic origin. Nasopalatine duct cyst (incisive canal cyst) is a kind of fissural cyst, which is relatively common in oral cavity. In radiographic view, this is a well circumscribed radiolucency of round or heart shape at the midline of the anterior maxilla, and commonly located at apical area of central incisors. However, root resorption is rarely noticed. In the histopathological view, the nasopalatine duct cyst characterized as the moderate-sized nerves and

| Table 1. Analyzing the present GOC in comparison with 32 cases of GOC in literature.1-28 |
|---------------------------------|---------------------------------|---------------------------------|
| **Location**                    | **Literature (32 cases)**       | **Present case**                |
| anterior maxilla:               | 8                               | anterior maxilla                |
| anterior mandible:              | 24                              |                                 |
| **Gender**                      |                                  |                                 |
| female:                         | 17                              | male                            |
| male:                           | 15                              |                                 |
| **Age**                         |                                  |                                 |
| 10-19 yrs:                      | 4                               |                                 |
| 20-29 yrs:                      | 2                               |                                 |
| 30-39 yrs:                      | 3                               |                                 |
| 40-49 yrs:                      | 1                               |                                 |
| 50-59 yrs:                      | 7                               |                                 |
| 60-69 yrs:                      | 1                               |                                 |
| 70-79 yrs:                      | 1                               | 17 yrs old                      |
| 80 and over:                    | 2                               |                                 |
small muscular arteries, and veins found in the wall of cyst, because it arises within the incisive canal.\textsuperscript{7,11,18}

In contrast to these properties, the present case was found in maxillary canine (\#23) area involving impacted mesiodens. These findings might directly indicate that the present case was an odontogenic cyst. And there were no large blood vessels and nerve bundles in the microsections.

The possibility of fissural cyst still existed because of its similar incidences to other fissural cysts, analyzed in the literatures. When analyzing a review of 32 cases of GOC hitherto reported,\textsuperscript{1-28} 24 cases occurred in mandible and 8 cases in maxilla, Favorable Gender distribution was 15:17 in male-female ratio, Gender predilection was not significantly found, When analyzing ages of decades occurred GOC, fifth decade was most common, and the mean age was 48.6 years (Table 1).

The non-odontogenic cysts usually occur from the nasopalatine duct (incisive canal) as well localized round cysts at anterior maxilla, lined by ciliated columnar epithelium but devoid of glandular structures forming microcysts. Generally the non-odontogenic cysts are not accompanied with enamel epithelial rests from impacted tooth or periodontal tissue, However, the differential diagnosis between GOC and non-odontogenic cyst in anterior maxilla is somehow difficult in case of absence of impacted tooth involving the cyst lumen, In the present case, besides the impacted teeth in the cyst lesion the histochemical and immunohistochemical stains showed the characteristic glandular features of glandular origin as well as the positive reaction of odontogenic biomarkers of ameloblastin in the cyst epithelium.

The present case of GOC showed remarkable growth potential of cyst epithelium in the immunostain of PCNA, which also consistantly positive for ameloblastin but rarely positive for amelogenin, The cyst epithelium was basically arranged in the stratified fashion, partly differentiated into the ciliated secretory epithelium forming glandular structure, which was strongly positive for mucin and PRP. These findings might indicate that the glandular elements were derived from hamartomatous secretory organ similar to the salivary gland, This odontogenic cyst showed abnormal proliferation of embryonal rests of enamel epithelium, which might have a potential to be differentiated into not only the enamel organ but also the salivary gland, On the other hand, the abundant mucous materials were accumulated in the cyst lumen, gradually recruiting the foreign body reaction of macrophages.

The present case of GOC occurred at anterior maxilla with the histological features of ciliated epithelial cells similar to the nasopalatine duct cyst. But it clearly involved the impacted teeth of mesiodens and canine, thus easily diagnosed as GOC after histological observation.

However, the present GOC demonstrated the positive reaction of ameloblastin in the cyst epithelium of resembling the enamel organ epithelium, and also showed strong reaction of mucin and PRP resembling the ductal and acinar cells of salivary gland, There also appeared active foreign body reaction by macrophages frequently found in the mucous retention phenomenon of salivary gland.

Taken together, we assumed that the present case of GOC was originated from the odontogenic epithelium of impacted teeth with the cytodifferentiation of glandular epithelium.

\textbf{IV. Reference}


27. Waldron CA, Koh ML: Central mucoepidermoid carci-
