Differential Diagnosis Between Cyst and Tumor

Dentigerous Cyst and Ameloblastoma Containing Teeth

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Summary

A study was conducted on 21 cases of ameloblastoma (a type of tumor containing an embedded tooth) and 87 cases of dentigerous cyst. The former cases were selected from among those which had been diagnosed histopathologically. Using radiographs of these lesions, the following parameters were measured: 1) the distance between the cement-enamel junction of the embedded tooth and its attachment to the cystic wall; 2) the area of the radiolucent image (similar to the area with a cystic appearance). From measurements of the former parameter, it appeared that the embedded tooth extends more toward the root apex in ameloblastoma than in dentigerous cyst, whereas the latter parameter indicated that the radiolucent area varies in size slightly in ameloblastoma, but tends to be smaller in dentigerous cyst.

Moreover, with regard to clustering between ameloblastoma and dentigerous cyst, no definite tendency was detected on distance, whereas only ameloblastoma without dentigerous cyst was seen above 20 cm² of area.

Introduction

Ameloblastomas containing teeth are not uncommon accounting for about 1/3 to 1/2 of all cases of this odontogenic tumor^[1-5]. The roentgenographic appearances of tooth-containing ameloblastoma and dentigerous cyst are so similar that it is often difficult to differentiate between them. Moreover, in Japan, in contrast to dentigerous cyst, ameloblastoma is classified histopathologically into three types^[6], which require fundamentally different forms of treatment because of their different natures^[7-9]. Accordingly, methods for differentiating these two types of lesion have been sought, and their various features have been investigated radiologically, including location, morphology, boundary, cystic content and adjacent tissues (including adjacent teeth)^[10,11]. In line with this research trend, we

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have suggested previously that for differentiation between ameloblastoma containing an embedded tooth and dentigerous cyst, the distance between the cervical point and the root attachment surface of the embedded tooth^[1] may be a useful parameter.

In the present study, as a possible means for differentiating between dentigerous cyst and ameloblastoma containing an embedded tooth, in addition to the distance between the cement-enamel junction and the cystic wall attachment of the embedded tooth, we measured the area of the radiolucent image.

Materials and Methods

The study cases were taken from among patients treated at the Hospital attached to the School of Dentistry at Matsudo, Nihon University, and included 21 cases of ameloblastoma (of the type containing an embedded tooth) and 87 cases of dentigerous cyst. The former cases were selected from among those which had been diagnosed histopathologically. In both types of lesion selected for study, the embedded teeth were those with complete roots (Table 1).

The ages of the patients whose lesions were studied are shown in Fig. 1 for ameloblastoma, and in Fig. 2 for dentigerous cyst.

The distance between the cement-enamel junction and the attachment to the

Table 1 Study Data

Ameloblastoma		Dentigerous Cyst	
Male	11 Cases	Male	51 Cases
Female	10 Cases	Female	36 Cases
Total	21 Cases	Total	87 Cases

Fig. 1 Age distribution of patients with ameloblastoma

Fig. 2 Age distribution of patients with dentigerous cyst

Fig. 3 Example of measurement parameters

cystic wall of the embedded tooth (hereafter referred to as “distance”) was expressed as a ratio relative to the total root length, as shown in Fig. 3. When the tooth was of the single-root type, we carried out measurement at both the mesial and distal sides of the root, whereas for multi-root type teeth, we measured the most mesial and distal sides of the roots. The measurements were averaged in each

case. We measured the area of the radiolucent image (hereafter referred to as “area”), similar in appearance to that of a cyst, using an image-processor (PIAS-II, PIAS).

Since it is believed that general data show a normal distribution^[12], we tested our results by the probability-plotting method^[13,14]. By excluding abnormal values using this method, our results approximated a normal distribution. Then, “distance” was plotted on the abscissa (X-axis) and “area” on the ordinate (Y-axis) to obtain the scatter plot, as shown in Fig. 4. Since “area” was measured using lateral

Fig. 4 Bivariate (scatter) plot

oblique radiographs as well as panoramic ones, the error due to the viewing angle was estimated by calculating the correlation between the values obtained from panoramic radiographs and those from lateral oblique radiographs, in cases where both types of radiograph had been taken (Table 2).

Table 2 Correlation Matrix of Radiolucent Area

	P	E
P	1.000	
E	0.977	1.000

P: Panoramic Radiography

E: Extraoral Radiography

Results

Twenty-one cases of ameloblastoma containing an embedded tooth were used in the present study, the patients comprising 11 males and 10 females. As for cases of dentigerous cyst, 87 cases were studied, the patients comprising 51 males and 36 females (Table 1).

The age of patients with ameloblastoma showed a peak in the 20s, and another smaller peak in the teens, with an average age of 23.4 years. By sex, the peak for male patients was in the teens, and that for females in the 20s (Fig. 1). The age of patients with dentigerous cyst showed a peak in the 20s, and other smaller peaks in the teens and 30s, with an average age of 32.9 years. By sex, the peak age for males was in the 30s, and that for females in the 20s (Fig. 2). The results for “distance” are shown in Fig. 3. The “distance” distribution for ameloblastoma had no distinct peak (0.5 ± 0.3 , mean $\pm$ SD), whereas dentigerous cyst had a peak at $0.2 (0.3 \pm 0.3)$.

The “area” distribution for ameloblastoma had a peak at $10\text{--}20 \text{ cm}^2 (19.90 \pm 10.23 \text{ cm}^2)$, whereas that for dentigerous cyst had a peak at less than $10 \text{ cm}^2 (4.17 \pm 4.54 \text{ cm}^2)$.

The measurements for “distance” and “area” were then subjected to probability-plot analysis. After removing the aberrant points (so that the remaining points had an approximately normal distribution), a scatter-plot was drawn between “distance” and “area” values (Fig. 4). For “distance”, no apparent tendency was observed between ameloblastoma and dentigerous cyst, whereas for “area” only ameloblastoma without dentigerous cyst occurred at values above 20 cm^2 .

It should be noted here that when the aberrant points were excluded, the “distance” and “area” measurements for ameloblastoma had average values $\pm$ SD of 0.5 ± 0.3 and $19.90 \pm 10.23 \text{ cm}^2$, respectively. The corresponding values for dentigerous cyst were 0.3 ± 0.3 for “distance” and $3.68 \pm 5.04 \text{ cm}^2$ for “area”.

There were 36 cases (12 ameloblastoma and 24 dentigerous cyst) for which the lesions were subjected to panoramic as well as lateral oblique radiography, and the error, 2.3% as shown in Table 2, resulting from measurement using lateral oblique radiography was calculated by comparing two kinds (panoramic and lateral oblique films) of measurement for the same objects (i.e., correlation coefficient).

Discussion

The age distribution of patients attending our clinic showed a peak in the 20s for both ameloblastoma and dentigerous cyst, and thus the two distribution patterns were similar. However, when compared numerically, the average age of patients with ameloblastoma was 23.4 years whereas that of patients with dentigerous cyst was 32.9 years, or about 10 years older than the former. Ito^[7,8] reported that in Japan ameloblastoma appears most commonly in persons in their 20s, and that its frequency of occurrence is about 70% between 10 and 40 years. On the other hand, the frequency of dentigerous cyst according to age is highest in the second decade, followed by the third and first decades. YAMAZAKI et al.^[4] noted

that in Japan ameloblastoma is most frequent among persons in their teens, followed by those in their 40s. In western countries, LUCAS^[2] maintained that ameloblastoma is generally most common between the 20s and 50s, whereas SHEAR^[15] found that dentigerous cyst appeared most frequently in the teens to 20s. While these previous results indicated that the age at which persons are most susceptible to ameloblastoma is generally lower than that at which they are most vulnerable to dentigerous cyst, the present findings are in obvious contrast to them. By sex, there seems to be no predilection to ameloblastoma, whereas males are more sensitive to dentigerous cyst. In a survey of Japanese subjects, ITO et al.^[7,8] found no sex difference in vulnerability to ameloblastoma, although males were more often affected by dentigerous cyst. By contrast, KAYANO^[5] claimed that males were more vulnerable to both ameloblastoma and dentigerous cyst. YAMAZAKI et al.^[4] asserted that females were more susceptible to dentigerous cyst. In western countries, males are said to be more vulnerable to both ameloblastoma^[2] and dentigerous cyst^[4]. The present results essentially agree with the previous findings for dentigerous cyst, but differ somewhat for ameloblastoma.

In the previous report^[1], by “distance” we implied the distance between the cement-enamel junction and the root attachment of the embedded tooth. However, since ameloblastoma also occurs with cyst formation^[6], we measured the “distance” from the cement-enamel junction to the cystic wall attachment in the present study. The “distance” was expressed as a ratio relative to the total root length instead of the actual “distance” on the radiograph, because it is better to use a relative value to avoid error due to the tortuosity of the measured root or the degree of enlargement of the radiograph. However, there is still some difficulty in measuring a root with an extremely crooked apex. Therefore in this study such extreme cases were excluded, and less tortuous roots were selected. In the previous study the root length was 0.4 on average for ameloblastoma and 0.3 for dentigerous cyst^[1]. A new set of measurements was obtained in the present study of a larger sample, yielding an average value of 0.5 for ameloblastoma and 0.3 for dentigerous cyst, thus increasing the difference between the two types of lesion. This suggests that a larger sample size may be a further aid by which to facilitate differentiation between ameloblastoma (containing an embedded tooth) and dentigerous cyst.

In addition, we measured “area” by tracing the contour of the radiolucent image and measuring its enclosed area with an image-processor (PIAS-II, PIAS). This measurement was adopted because cysts in ameloblastoma tend to be large, whereas dentigerous cysts vary widely in size^[5,7,8]. As a result, it was found that the average “area” for ameloblastoma (containing an embedded tooth) was 19.90 cm², whereas that for dentigerous cyst was 4.17 cm². The difference was thus obvious, clearly verifying the effectiveness of this type of measurement.

General data show a normal distribution^[12]. Since a normal distribution is very simple in that it is determined by only two variables, average and standard deviation, it is a highly descriptive tool for use in applied mathematics as well as statistics^[16]. With this in mind, we tested whether the present results agreed with a normal distribution using the probability-plotting method^[13,14]. Since this method is applicable to multivariate analysis^[13], we used it to analyze the present

results to differentiate between ameloblastoma and dentigerous cyst, excluding aberrant data. As a result, we found that for the "distance" measurement, as the numerical data show, the embedded tooth in ameloblastoma tends to extend more toward the root apex at the cystic wall attachment than does its counterpart in dentigerous cyst, whereas for the "area" measurement, ameloblastoma is larger than dentigerous cyst. When compared by scatter-plot, no marked difference was seen for "distance" between ameloblastoma and dentigerous cyst, whereas for "area" only ameloblastoma without dentigerous cyst occurred above 20 cm². To confirm this result, however, it will be necessary to reinvestigate a larger sample.

With regard to the "distance" measurement of the embedded tooth, which was introduced by ABRAMS et al.^[17] and LUCAS^[2], we were unable to confirm statistically for ameloblastoma that the "distance" becomes larger with progression of the lesion, although for dentigerous cyst we confirmed such a tendency for both "distance" and "area" measurements.

The "area" was measured in some cases by panoramic radiography and in others by lateral oblique radiography. Thus, to determine the error resulting from the viewing angle, correlation coefficients were calculated using cases for which both panoramic and lateral oblique radiography had been performed. The error was 2.3%. Although the number of cases used for the error calculation (ca. 41%) was too low to make the findings conclusive, it is fair to say from the small size of the error that mixing the two kinds of data does not seriously distort the conclusion.

Conclusions

We studied 21 cases of ameloblastoma (containing an embedded tooth) and 87 cases of dentigerous cyst. The former were selected from among cases which had been diagnosed histopathologically. Using radiographs of these lesions, we measured the distance between the cement-enamel junction and the cystic wall attachment of the embedded tooth, as well as the area of the radiolucent image (resembling the image of a cyst). For the distance measurement, the tooth tended to extend more toward the root apex in ameloblastoma than in dentigerous cyst. For the area measurement of the cystic image, only ameloblastoma without dentigerous cyst occurred above 20 cm².

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