Morphological examination of impacted tooth in maxillary lateral incisor region using computed tomography for consideration of treatment modalities

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Abstract

A 10Y2M-old girl was referred to our clinic by a general practitioner for consultation regarding an impacted supernumerary tooth identified in the maxillary left incisor region. Our intraoral examination revealed a maxillary left lateral incisor with a tubercle morphology, with slight swelling identified in the labial gingival area between the lateral incisor and primary canine. The dental age of the patient was calculated to be 1 year behind her chronological age based on root formation observed in orthopantomographs. X-ray photographic examinations revealed an impacted tooth on the labial side, with the root apex presumably directed into the palatal side. Computed tomography (CT) was used to produce three-dimensional reconstruction images in order to obtain morphological information for the impacted tooth, which had a tuberculate shape and an appearance that differed from that of the tooth on the opposite side, which showed a typical morphology of a lateral incisor. Periodical examinations were performed thereafter, which confirmed the developmental progress of the root formation of the impacted tooth. At 11Y8M, the tooth had emerged into the oral cavity and was extracted under local anesthesia. Based on this case, we concluded that effective use of CT is beneficial for consideration of treatment modalities in patients with an impacted tooth.

Key words
Computed tomography, Diagnosis, Extraction, Maxillary lateral incisor, Supernumerary tooth

Introduction

Supernumerary teeth are reported to occur in permanent dentition in approximately 1–3% of the general population, with higher incidence in females, and the maxillary anterior region is known to be most frequently involved in cases with one or two supernumerary teeth1,2). It is considered that such teeth are the result of continued proliferation of permanent or primary dental lamina to form an additional tooth germ, and they are classified based on morphological features, such as conical, tuberculate, and supplemental types, or an odontoma3–5). Delayed eruption and displacement of adjacent permanent teeth are known as major complications, and extraction difficulties, impaction, and ectopic eruption have been reported for cases of supernumerary teeth with a dysmorphic shape2,6). As for supernumerary lateral incisors, excessive overjet, crowding, ectopic eruption, and midline shift have been described as major problems7).

In a previous report, we presented details of a case with two maxillary lateral incisors in one quadrant, in which both tooth crowns were identified in the oral cavity, even though they were outside of the dental arch8). In that case, treatment modalities were considered based on direct visual confirmation of the morphological features of the two teeth. In the present report, we describe a case with a
A 10Y2M-old girl was referred to our clinic by a general practitioner for consultation regarding an impacted supernumerary tooth identified in the maxillary left incisor region, which had been incidentally found in an orthopantomograph obtained for treatment of dental caries. Our intraoral examination showed a small-sized maxillary lateral incisor with space in both mesial and distal directions (Fig. 1). In addition, slight swelling was identified in the labial gingival area between the lateral incisor and primary canine. X-ray photographic examinations revealed an additional tooth, whose crown was located on the labial side of the lateral incisor, while the root apex was presumably directed into the palatal side (Fig. 2A and Fig. 3). When the conditions of these teeth were reported, the mother of the patient requested information regarding possible treatment modalities. We used CT findings to produce reconstructed three-dimensional images to elucidate the morphology of the impacted tooth, which demonstrated a tuberculate morphology with a root apex that was ambiguous (Fig. 4). As compared to the small-sized tooth observed in the dental arch, the morphology of the impacted tooth had a better appearance and larger mesio-distal width, though it was apparently smaller and had a different morphology as compared to the tooth on the opposite side, which had a typical morphology of a lateral
Table 1 summarizes the features of the erupted and impacted maxillary lateral incisors as compared to those of the tooth on the opposite side. The mesiodistal dimensions of both left lateral incisors were smaller as compared to the right lateral incisor, while the size of the right lateral incisor was also small as compared to the mean value for Japanese girls, though it was within 1SD of the normal range.\textsuperscript{9} The dental age of the patient was calculated based on root formation observed in the orthopantomograph using the method of Haavikko\textsuperscript{10}, which was shown to be applicable for Japanese subjects\textsuperscript{11}. 

Fig. 2 Orthopantomographs obtained at the first and following periodical examinations (A) 10Y2M, (B) 10Y11M and (C) 11Y8M.

Fig. 3 Axial X-ray photograph obtained at the first visit
Fig. 4 Three-dimensional images generated by reconstruction of CT data
Shown are labial (A-D), palatal (E-H), and axial views (I-L).

Table 1  Clinical features of maxillary left lateral incisor located in arch and that located labio-palatally
as compared to maxillary right lateral incisor

<table>
<thead>
<tr>
<th></th>
<th>Maxillary right lateral incisor</th>
<th>Maxillary left lateral incisors</th>
<th>Mean of Japanese girls</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Erupted</td>
<td>Impacted</td>
<td></td>
</tr>
<tr>
<td>Mesio-distal crown</td>
<td>6.40</td>
<td>4.69</td>
<td>5.47</td>
</tr>
<tr>
<td>dimension (mm)</td>
<td>±0.69</td>
<td></td>
<td>7.00±0.69</td>
</tr>
<tr>
<td>Development of tooth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>formationa</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10Y2M (8.8 ± 1.1)</td>
<td>Ac</td>
<td>Ac</td>
<td>R3/4 (8.0)</td>
</tr>
<tr>
<td>10Y11M (9.7 ± 1.0)</td>
<td>Ac</td>
<td>Ac</td>
<td>Rc (8.5)</td>
</tr>
<tr>
<td>11Y8M (10.7 ± 0.3)</td>
<td>Ac</td>
<td>Ac</td>
<td>Ac</td>
</tr>
<tr>
<td>Eruption time (age)c</td>
<td>A.E.</td>
<td>A.E.</td>
<td>11Y8M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>8Y0M±8M</td>
</tr>
</tbody>
</table>

a: The dimensions were determined from study casts obtained at the first examination. As for impacted maxillary left lateral incisor, the dimension of the extracted tooth was directly measured. The mean value for the dimension in Japanese girls was reported by Ooshima et al.9).
b: Values in parentheses included with chronological age show the average ± SD of the dental age of the entire dentition. “Ac” indicates apex completed, and “R3/4” and “Rc” indicate three-fourths and complete root formation, respectively. Values in parentheses included with values root formation indicate the dental age of the maxillary lateral incisor.
c: “A.E.” indicates that the tooth had already erupted at the first examination (conducted at the age of 10Y2M). The mean value for the eruption time was reported by the Japanese Society of Pedodontics12).
The dental age of all dentition was approximately 1 year behind her chronological age, and that of the impacted tooth was approximately 2 years behind.

We determined that two treatment modalities were available, in which either of the left lateral incisors could be used as the maxillary left lateral incisor. If the erupted tooth was selected for use as the maxillary left lateral incisor, we would wait for spontaneous eruption of the impacted while observing development of the root formation. The impacted tooth would then be extracted after it had emerged into the oral cavity or, if did not erupt, extraction would be done when development of root formation had finished. We explained to her mother that the main advantage of this modality was its lower level of invasiveness, while a disadvantage was the esthetic problem related to the morphological appearance. On the other hand, if the impacted tooth was selected for use as the maxillary left lateral incisor, we would then extract the erupted tooth immediately and perform fenestration on the tooth. Thereafter, we would begin movement of the impacted tooth into position in the dental arch. We explained that the main disadvantages of this choice were increased invasiveness, as well as time and cost until completion, whereas its primary advantage was a better esthetic appearance. However, the CT reconstruction images demonstrated that the appearance of the impacted tooth was different from that of the opposite side lateral incisor, thus her mother requested to take the first treatment choice.

Several periodical examinations were performed, and the progress of root formation of the impacted tooth was confirmed (Fig. 2B). At 11Y8M, the impacted tooth had emerged into the oral cavity (Fig. 2C and Fig. 5) and was extracted under local
anesthesia. The morphological appearance was consistent with that shown by the three-dimensional reconstruction of CT images (Fig. 6). The mesiodistal dimension was larger than that of the erupted tooth by 0.8 mm, though it was significantly smaller than that of right lateral incisor by 0.9 mm (Table 1). One week after the extraction, gingival healing was confirmed. At that time, neither the patient nor her mother considered the esthetic problems to be serious, though we informed them of possible prosthetic approaches in the future for the small-sized lateral incisor.

Discussion

X-ray photographic examinations are crucial for treatment planning in cases of impacted teeth. In general, combinations of several images showing multiple angles can help to estimate the morphology and location of such teeth. On the other hand, we occasionally encounter difficulties with morphological estimations that are different from the actual tooth, which are confirmed following surgical extraction. Recently, CT examinations have become widely used in the field of general dentistry, and development of three-dimensional reconstruction techniques has enabled better understanding of the actual morphology and location of impacted teeth, which provide advantages for proper diagnosis, consideration of treatment modalities, and performing surgical procedures. In addition, the resultant images are useful for explanation of diagnosis and possible treatment modalities to patients and their guardians, especially when several different treatment modalities can be chosen.

The morphology of the tooth crown and root is very important when constructing a treatment plan for cases of impacted teeth, and several recent reports have shown the usefulness of three-dimensional reconstruction images\(^{13,14}\). In the present case, CT reconstruction images demonstrated that the morphology of the impacted tooth was better than that of the lateral incisor in the arch, while they also showed that it was not similar to the tooth on the opposite side. Therefore, the mother of the patient selected extraction of the impacted tooth rather than the tooth located in the dental arch. If the morphological appearance of the impacted tooth had been quite similar to that of the maxillary right lateral incisor, she might have selected the other possible treatment modality. Without access to the CT reconstruction images, it would have been difficult for her to fully understand the circumstances related to her daughter and the available options. In addition, conventional X-ray photographic images do not enable understanding of the actual morphological features of an impacted tooth, which might hinder treatment planning.

Teeth typically emerge into the oral cavity when root formation reaches two-thirds to three-fourths completion\(^{10}\). The mean age for emergence of maxillary lateral incisors into the oral cavity in Japanese girls has been reported to be 8Y0M\(^{12}\). In the present patient, the maxillary right lateral incisor with a standard morphology and a small-sized tooth on the opposite side were identified at the age of 10Y2M at the first visit to our clinic. Since the dental age of the patient was demonstrated to be 1 year behind her chronological age, we concluded that these teeth had just completed emergence prior to the first visit. On the other hand, the root formation of the impacted tooth was found to be two-thirds completed at the first visit, indicating that the tooth would probably erupt spontaneously. Fortunately, the CT images allowed us confirm that no interference existed in the pathway to eruption and we decided to wait for spontaneous eruption. One and a half years after the first visit, the tooth was emerged into oral cavity and was easily extracted.

Previously, we treated an 8-year-old girl with two maxillary left lateral incisors, and palatal and labial displacement of the mesial and labial teeth, respectively\(^8\). In that case, the mesial tooth was considered to be a supernumerary tooth, based on crown morphology, dental age, and eruption time, and was extracted, which solved the space shortage problems in the arch. In the present case, the extracted tooth was located outside the dental arch and there were no space shortage problems. In addition, there was additional space in both mesial and distal directions, which could have provided space for a tooth the same size as that on the opposite side, though the space would need to be maintained until the patient matured and final prosthetic treatment was performed. However, the patient and her mother did not choose this option and we have no plan for intervention for the tooth.

In summary, we treated a patient with an impacted tooth identified at the maxillary lateral incisor region. Conventional X-ray photographic images assisted estimation of the location and morphology of the tooth. In addition, three-dimensional reconstructions
of obtained CT images were very helpful to obtain important information regarding possible treatment plans.

Acknowledgments

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References