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Use of spiral computed tomography in the assessment of diagnostically difficult impacted teeth

Impacted teeth in the anterior segment of the maxilla are relatively common in orthodontic practice (from 0.9% to 4.3%)(6). They constitute a problem not only for the patient who experiences the discomfort of a lacking tooth in the front segment, but also for the dentist who has to take into account the possible resorption of adjacent teeth. In planning the surgical-orthodontic treatment of such teeth, their precise localization and accurate assessment of their positioning in relation to adjacent anatomical structures as well as to the roots of adjacent teeth, are essential. In order to minimize the risk of root resorption, it is extremely important to detect any abnormal contact between impacted teeth and the roots of adjacent teeth early enough. Conventional radiography in the form of panoramic radiography, or intraoral and occlusal x-rays adds successfully to the clinical examination in cases of eruption disturbances. However, information carried by conventional radiographs is limited by their two-dimensional rendering of spacial objects, which always necessitates several pictures. They help localize impacted teeth but fail to detect root resorption. The lack of spacial rendering of tissues makes it impossible or at least very difficult to detect and evaluate the lesions (1, 3, 10).

Computed tomography (CT) adds to diagnostics, supplying more information about impacted teeth. Relatively recent introduction of spiral CT perfected computer scanning reducing examination time, thus reducing artefacts caused by movement (7). Spiral CT does not only precisely localize examined teeth and show their structure but also enables one to determine the extent of adjacent tooth root resorption (1, 5).

The aim of the study was to assess the usefulness of spiral CT in the assessment of diagnostically difficult impacted teeth.

MATERIAL AND METHODS

Three patients aged 12.4, 14.9, and 30.2 years were examined clinically and radiologically (panoramic x-ray) and revealed three impacted canines and one impacted central incisor. Due to impossible precise assessment of tooth location in relation to surrounding anatomical structures and their relationships with adjacent teeth, apart from traditional radiographs we also performed spiral CT of the maxilla. CT scans of alveolar processes of the maxilla were performed using spiral technique with a S E apparatus by Siemens, with slice thickness of 1 mm and pitch equal 1.5. The examination was performed in axial planes. Secondary multiplanar reconstructions (MPR) were performed from numerary data of the examined region in randomly selected planes and volume rendering reconstructions (VRT). CT scanning was carried out at 130 kV and 120 mA.

Case 1. The panoramic dental x-ray of a patient aged 12.4 years revealed in the right half of the maxilla two impacted teeth (the canine and the central incisor), hypoplasia of the lateral incisor, and agenesis of the second premolar. On the left in the region of the lateral incisor there was a supernumerary tooth (Fig.1A). In order to localize impacted teeth more precisely spiral CT scanning was performed. The 3-dimensional picture accurately presented the relationships between impacted teeth and adjacent structures and, what is more, showed dilacerations in half the root of the central incisor, which was not to be seen in the panoramic radiograph (Fig. 1B).

Fig. 1A. Visible in the panoramic x-ray in the right half of the maxilla, an impacted canine and central incisor, a hypoplastic lateral incisor, a missing bud of the second premolar and a supernumerary tooth in the vicinity of the left lateral incisor

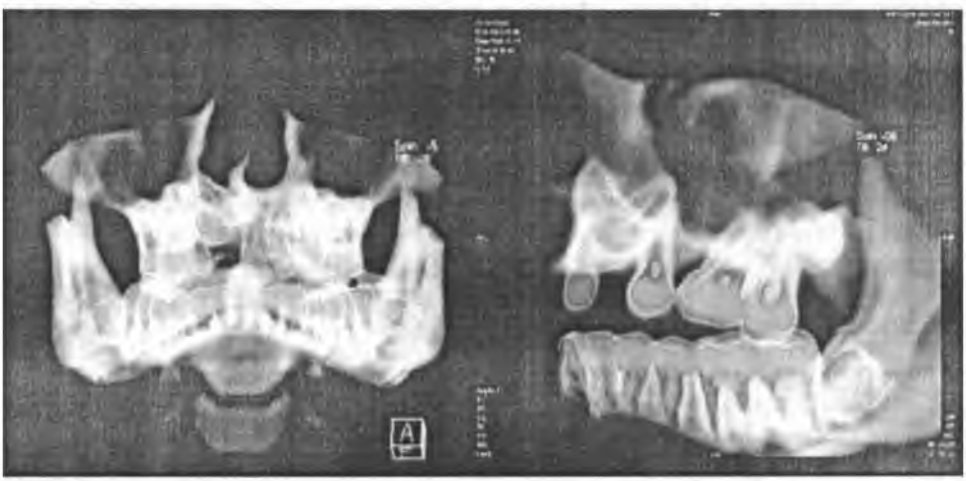

Fig. 1B. The 3D VRT (volume reconstruction technique) image showed a dilaceration of the right central incisor and determined the relationships of impacted teeth with each other and with neighbouring structures

Case 2. Patient aged 14.9 presented with a horizontally placed upper left lateral incisor and a lack of left upper canine. A panoramic x-ray was performed which revealed high on the left in the maxilla an impacted canine and a follicular cyst nearby (Fig. 2A). The CT scan confirmed the presence of the cyst, made clear the position of neighbouring teeth in relation to the cyst and allowed

for the assessement of its size (1.0–1.2 cm). Axial scans of the spiral CT revealed resorption of the mesial wall of the first left premolar adjacent to the impacted canine. The resorption involved cementum and a part of radical dentine (Fig. 2B. C, D).

Fig. 2A. Visible in the panoramic x-ray an impacted upper left canine and a cyst in the region of the left lateral incisor and impacted canine

Fig. 2B. An axial CT scan of the upper left canine reveals a follicular cyst sized 1.0 by 1.2 mm and resorption of the upper left first premolar

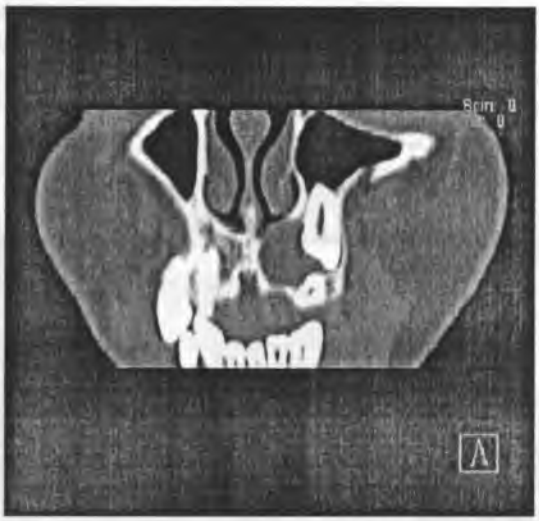

Fig. 2C. MPR reconstruction in the frontal plane across the cyst

Fig. 2D. Visible in the 3D VRT image location of adjacent teeth in relation to the cyst

Case 3. The clinical examination of patient aged 30.2 years demonstrated malocclusion in the form of overbite, a diminished-in-size upper/lower left lateral incisor and absence of upper left canine and two lower first molars. The panoramic radiograph showed the impacted upper left canine, which overlapped the left lateral and central incisors. The top of the crown of the impacted canine reached the median line of the maxilla (Fig. 3A). CT scans revealed resorption of the lateral incisor root, with a thin sheet of radical dentine left, and severe (reaching the pulp) resorption of central incisor root (Fig. 3B).

Fig. 3A. Visible in the panoramic x-ray in the maxilla on the left, an impacted canine, a persisting deciduous canine and a hypoplastic lateral incisor

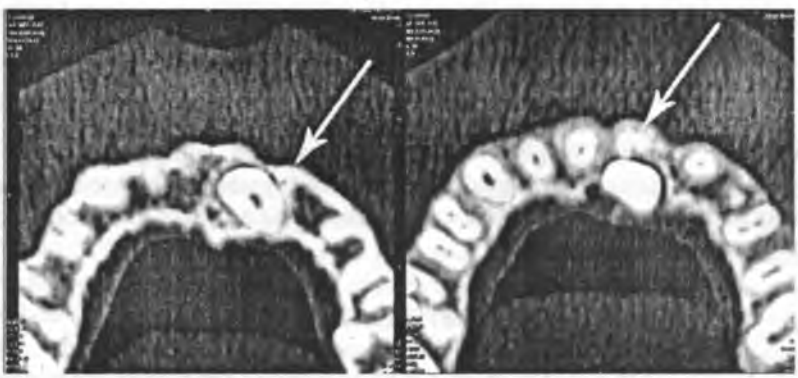

Fig. 3B. Computed tomography revealed resorption of the lateral incisor root and a severe resorption of the central incisor root (reaching the pulp)

DISCUSSION

In surgical-orthodontic treatment of impacted teeth appropriate pre-operative planning depends on exact location as well as accurate assessment of spacial relationships with adjacent anatomical structures, especially with neighbouring teeth. Contact between impacted teeth and roots of neighbouring teeth increases the risk of resorption, especially in the case of permanent incisors. Correct and timely recognition of root resorption is crucial, if such serious complications as the loss of permanent teeth are to be avoided (7).

It has been pointed out by researchers over the last few years that practitioners neglect upper incisor root resorption caused by impacted canines, although it occurs in 12.5% of individuals with impacted canines (3, 9). Due to location next to canines, resorption of lateral incisors occurs four times more frequently than of central incisors (4). In the present study two of our patients showed root resorption on three teeth adjacent to the impacted tooth. Correct assessment of impaction site (palatal or buccal) is possible both by clinical examination and with conventional radiography,

especially with the tube-shift technique. However, conventional techniques fail when we want to correctly assess the possible contact of the impacted tooth with adjacent structures and consequent incisor root resorption (especially when dentine loss is buccal or lingual. This is mainly caused by canine overlapping incisors, but also by the amount of resorption compared with root thickness (7). We agree with other authors that the use of spiral computed tomography substantially increases the percentage of accurately diagnosed impacted teeth (5, 10).

Supplementing of axial CT scans with MPR makes possible diagnosing of minimal lesions, only suspected on axial images, whereas 3D reconstructions improve the three-dimensional localization of impacted teeth, enabling the orthodontist to plan the most effective treatment (5, 10). By reducing examination time spiral tomography markedly increases patient comfort and helps prevent accidental movements, thus reducing the number of artifacts. In agreement with other authors, we consider CT the optimal diagnostic tool for impacted teeth with suspected adjacent tooth resorption (3, 5, 7, 8).

Because radiation with CT is greater than with conventional radiography, every case should be considered separately and the use of CT should be limited to cases where conventional radiography fails to accurately present actual relationships between impacted teeth and roots of neighbouring teeth: there, though, the timely recognition of, however minimal, root resorption prevents damage which in time may appear so severe as to lead to permanent tooth loss (7). CT is also justified when the case is complex due to multiple impactions and the presence of supernumerary teeth.

CONCLUSIONS

Spiral CT scanning supplies additional information compared to conventional radiography. It facilitates exact spacial localization of impacted teeth, detection of possible adjacent tooth root resorption, as well as evaluation of the size and character of dilacerations of the impacted tooth.

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SUMMARY

The aim of the study was to evaluate the usefulness of spiral computed tomography for diagnostically difficult cases of tooth impaction. The paper describes three patients, aged 12.4, 14.9, and 30.2 years, with clinically and radiologically (panoramic radiogram) diagnosed three impacted canines and one impacted central incisor. Due to impossible precise assessment of impacted tooth location in relation to surrounding anatomical structures and their relationships with adjacent teeth, traditional radiographs were supplemented with a spiral CT of the maxilla. In two of the patients the CT scans detected resorption of the roots of three teeth adjacent to impacted teeth, the dilacerations of the central incisor, and allowed for adequate assessment of the sizes of follicular cyst and impacted teeth. Spiral CT gives extra information compared to conventional radiography. It facilitates exact spacial localization of impacted teeth, detection of possible adjacent tooth root resorption, as well as evaluation of the size and character of dilaceration of the impacted tooth.

Zastosowanie spiralnej tomografii komputerowej
w ocenie trudnych diagnostycznie zębów zatrzymanych

Celem pracy było określenie możliwości zastosowania spiralnej tomografii komputerowej w ocenie trudnych diagnostycznie przypadków zębów zatrzymanych. Praca jest opisem trzech pacjentek w wieku 12, 14 i 30 lat, u których za pomocą badania klinicznego i radiologicznego (zdjęcie pantomograficzne) zdiagnozowano trzy zatrzymane kły i jeden siekacz przyśrodkowy. Z powodu braku możliwości dokładnego określenia położenia zębów zatrzymanych względem otaczających struktur anatomicznych i ich wzajemnych relacji z sąsiadującymi zębami tradycyjne zdjęcia radiologiczne uzupełniono badaniem za pomocą spiralnej tomografii komputerowej szczęki. Badanie CT wykryło u dwóch pacjentek resorpcję korzeni trzech zębów przylegających do zębów zatrzymanych, ujawniło zagięcie koronowo-korzeniowe siekacza przyśrodkowego, pozwoliło określić dokładne wymiary torbieli zawiązkowej oraz zębów zatrzymanych. Spiralna tomografia komputerowa dostarcza dodatkowych informacji w porównaniu z radiografią konwencjonalną. Umożliwia dokładniejszą lokalizację przestrzenną zatrzymanych zębów, wykrycie ewentualnej resorpcji korzeni sąsiednich zębów oraz określenie wielkości i charakteru zagięcia koronowo-korzeniowego zęba zatrzymanego.