Application of Computed Tomography for Supernumerary Teeth Location in Pediatric Dentistry

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Conventional radiographs provide bi-dimensional images of three-dimensional structures limiting optimal treatment planning. To overcome this deficiency, Computed Tomography (CT) has been used as a diagnostic method in Medicine and Dentistry. CT allows for supernumerary teeth location, the establishment of positional relations with other teeth, and the assessment of surrounding bone thickness; thus, facilitating surgical access and technique choice while reducing the procedure time, of great importance in pediatric dental care. The aim of this study was to present the possibility of applying CT for supernumerary teeth location, through the case report of a five-year-old female patient presenting two supernumerary teeth in the anterior palatal area. In conclusion, CT appears to be an excellent image diagnostic method for locating unerupted supernumerary teeth, providing precise information for planning and performing the surgical approach, while reducing operatory time and post-operatory complications; factors of extreme importance when treating young children.

Keywords: *computer tomography; supernumerary teeth.*
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INTRODUCTION

Image diagnostic exams have improved in the last decades. Modern technologies involve radiation, wave reflection and electromagnetic fields, as well as computer resources that have contributed to more precise image acquisition. Image diagnosis is useful in Medicine, and Dentistry and further research has been performed to justify its application in new areas.

Computed Tomography has been indicated for Implant dentistry, cases of complex fracture interpretation, craniofacial anomalies, maxillofacial neoplasias, multiplanar temporomandibular reconstruction and location of supernumerary teeth.[1]

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Helicoidal CT presents an image diagnostic method producing more precise 3D images of anatomic structures without superimposition, and preserving soft tissue detail.[2] This radiography technique also allows for the acquisition of images and cuts in real size, showing precise teeth position and their relation to adjacent anatomic structures.[3] CT must be requested as a diagnosis complement when the information provided by conventional radiographs is insufficient to establish safe diagnosis and surgical planning.[4] Helicoidal CT scans reduce image acquisition time, radiation doses (mean 0.5 to 2 rads), and the number of artifacts caused by peristaltic, respiratory and cardiac movements. The radiation dose must be rigorously evaluated by the professional, especially in children and young adults, due to the maximum risk of radiation exposure.[5] This technique can be applied to examine impacted and supernumerary teeth before surgical and orthodontic treatment.[6]

Dental CT allows for the reconstruction of panoramic and transversal images. The panoramic plane is defined by adjustment of a curved line to the mandible and maxillary arches in an axial detail reference. Sagital and oblique images perpendicular to the panoramic plane can be reconstructed for any distance selected.[7]

Supernumerary teeth have been defined as a developmental disturbance producing an excess of teeth. This alteration occurs during the formation of the dental germ, in the initiation period, when the cells present multiplication activity. Supernumerary teeth can be formed by hyperactivity or remains of the dental lamina, or even by division of the developing germ.[8]

The prevalence of supernumerary teeth can vary between 0.05% and 6.4% in different populations, frequently erupting in the primary dentition (75%), as opposed to the permanent dentition where only 25% erupt.[9, 10] The most common site of expression is palatally in the premaxilla.[8]

Supernumerary teeth can delay or prevent the eruption of permanent teeth and can cause ectopic eruption, displaced teeth, cyst formation and pathological root resorption.[11] When diagnosed, surgical removal is indicated to avoid these disorders. Some authors indicate the immediate removal and others prefer to wait for an almost complete development of the adjacent permanent teeth.[10, 12]

An early diagnosis and an accurate intervention are extremely important for the correct evolution of the dentition development. Usually the diagnosis is performed through conventional intra and extra oral radiographs (periapical, occlusal and panoramic), with the limitation of structural superimposition.[13] These modalities do not provide sufficiently detailed information concerning the 3D relationship between supernumerary or ectopically impacted teeth and adjacent structures.[14]

The CT provides an image without surrounding superimpositions, thus, facilitating the determination of the exact supernumerary location and its distance from the cortical bone.[3] The Helicoidal method also allows for the elimination of undesirable planes in the surgical area, offering a gray scale image without blots. The acquired image can also be reconstructed later.[15] The present study describes the images obtained through conventional and CT radiographs for the location of supernumerary teeth in a five-year-old child.

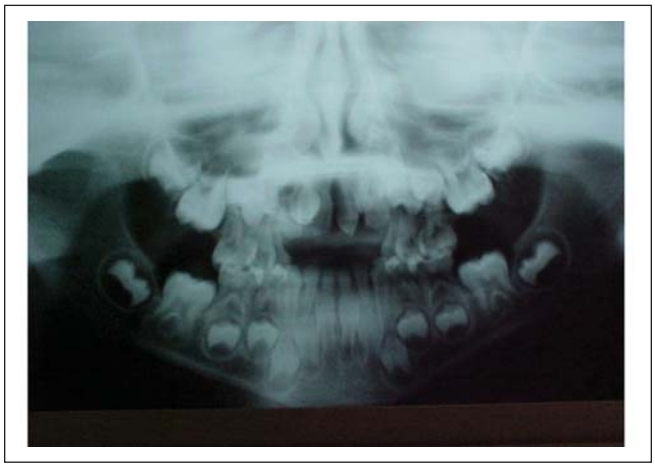

Figure 1. Panoramic radiograph

Figure 2. Maxillary occlusal radiograph

CASE REPORT

A five-year-old male patient was referred to the Pediatric Clinic of the Dental School of the Lutheran University of Brazil (Canoas, Brazil), for the surgical removal of supernumerary teeth.

Two different radiographic diagnostic methods were selected. First, conventional radiography was performed, with intra and extra oral radiographs, including a panoramic x-ray (Figure 1), upper occlusal (Figure 2) and upper right and left central incisor periapical radiography (Figure 3). The radiographic images confirmed the presence of two supernumerary teeth. Following the Clark's Technique it became evident that both were situated lingually to the upper central incisor germs. However, the images provided by these radiographs did not establish the real relation between the supernumerary teeth and the developing germs.

Due to the complexity of the case, a second method was chosen to complement the diagnosis: a maxillary CT with a dental CT program. Twenty-four oblique sections of 1mm thickness and 1.5mm space were performed. The oblique cut images were real size, in accordance with the vertical and horizontal measurements of the exam (Figure 4). The images showed the presence of two supernumerary teeth adjacent to the maxillary incisors. The supernumerary tooth closest to the right maxillary incisor presented complete crown and root formation. The crown was oriented towards the palatal

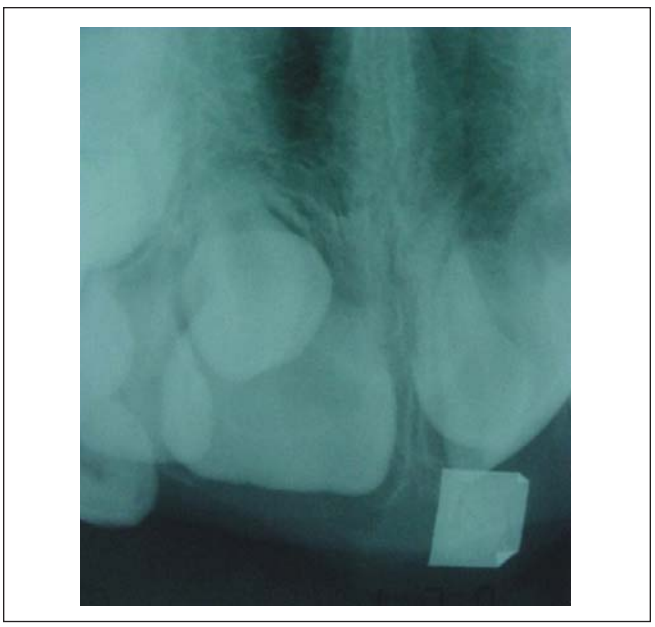

Figure 3. Right maxillary central incisor radiograph

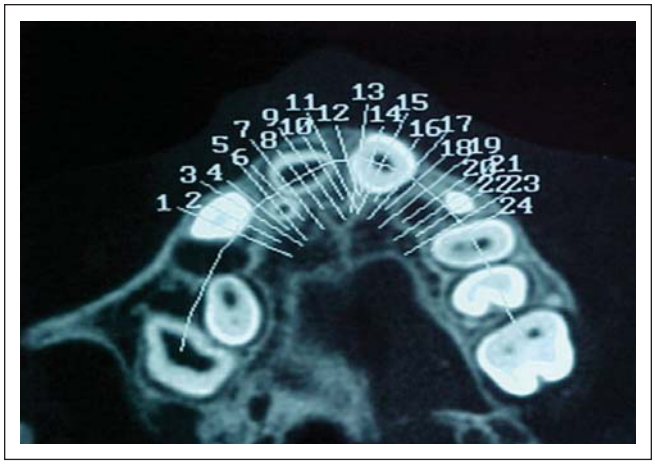

Figure 4. Maxillary CT

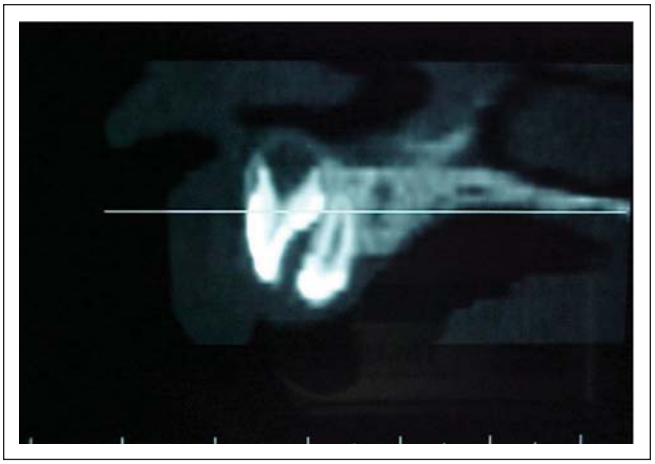

Figure 5. Right maxillary central incisor CT

mucosa, with reduced bone inclusion, and the root apex touching the right maxillary central incisor, which presented a buccal inclination, a complete crown and less than one third of its root formed (Figure 5). The supernumerary tooth closest to the left maxillary central incisor was palatally located, with complete crown and root formation under the palatal mucosa and with its apex near the nasoalveolar foramen. The left maxillary central incisor presented a complete and rotated crown and initial root formation (Figure 6).

Based on the images obtained, immediate surgery to remove both supernumerary teeth was the treatment of choice. Surgical access was achieved through a flap allowing for direct visualization of the bone convexity in the anterior palatal area, indicating the supernumeraries' location. The bone tissue covering the supernumerary tooth close to the right maxillary central incisor was removed with a chisel. The supernumerary tooth close to the left maxillary central incisor was only covered by mucosa. Both supernumeraries were easily removed due to the precision of the images provided by CT, simplifying access and reducing surgical time. Suturing was performed and one week later healing was complete. The patient did not report any post-operative pain.

Figure 6. Left maxillary central incisor CT

DISCUSSION

The present study shows the superiority of images provided by CT compared with conventional radiographs regarding the location of and surgical planning for supernumerary teeth. CT is the best image diagnostic method currently available, providing a higher resolution for hard tissues and determining the accurate location of retained teeth and their relation to adjacent tissues.[4] However, it is important to perform a cost-benefit analysis of the need for precision against the fact that the precise indication of this radiographic technique produces higher absorption of radiation by facial skin than conventional radiography. Therefore, the first choice must be the use of conventional radiography.[15] Nevertheless; a lower radiation dose cannot be justified if the imaging procedure does not provide the necessary quality to achieve a definitive diagnosis.[16]

CT image reformatting allows for visualization of dental morphology (root and crown). Moreover, it enables the evaluation of the degree of dental germ and supernumerary teeth development and determines their inclination in a buccal and palatine direction. In addition, this technique provides a detailed description of the positional relationship between the impacted and its neighboring tooth, which is not always available using conventional radiographs.[13, 17]

Because of the image superimposition that occurs with conventional radiography techniques, it is sometimes impossible to verify the proximity of the supernumerary teeth to the developing dental germs. In these situations, the best option is a more precise radiographic exam, such as CT. Once the removal of the supernumerary teeth has been decided, surgical planning must be carefully outlined. The choice of CT contributes to reducing the occurrence and severity of postoperative complications.[13]

Other studies should be conducted in Pediatric Dentistry, to determine the use of CT including a cost-benefit analysis, radiation levels and diagnostic indications.

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