DOI: 10.1111/j.1365-263X.2006.00783.x

The use of multidirectional cross-sectional tomography for localizing an odontome

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International Journal of Paediatric Dentistry 2007; 17: 129–133

Background. A 7-year old boy was referred with retained maxillary right primary central and lateral incisors. Radiographic exam revealed a large calcified radio-opaque mass overlying the roots of these primary teeth preventing the permanent teeth from erupting.
Case Report. The purpose of this paper is to describe the pre-operative use of multi-directional cross-sectional tomography in establishing the relationship between a large complex odontome that was preventing the eruption of a maxillary permanent central incisor.
Conclusion. Low dose, multi-directional cross-sectional tomography was beneficial in visualisation of the precise relationship between the large complex odontome and the unerupted permanent incisor. This allowed correct judgement of the position on the odontome prior to its surgical removal.

Introduction

Odontomes are hamartomatous developmental malformations of dental hard tissues. They can be differentiated into compound and complex forms. The compound odontome consists of small, discrete, tooth-like structures of enamel, dentine and cementum, so called denticles, whilst the complex odontome is a diffuse mass of randomly arranged enamel, dentine and cementum[1]. Compound odontomes are more common in the anterior maxilla, and complex odontomes in the premolar and molar regions[2,3].

Odontomes are most frequently diagnosed in the second decade of life[4], and only rarely in the primary dentition[5]. They usually cause failure of eruption of a permanent or primary tooth. They may also be associated with missing permanent teeth and, less commonly, cystic change[6].

Radiographically, odontomes may appear radiolucent whilst forming and become radio-opaque when fully formed. They are surrounded by a thin, radiolucent capsular space beyond which is a lining of compact bone which appears radio-opaque.

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Plain film radiographic images, such as a dental panoramic tomograph and an upper standard occlusal, may be used to detect and localize fully developed opaque odontomes in the anterior maxilla using the vertical parallax technique[7]. The true lateral cephalometric view may give further information regarding the anteroposterior position of the odontome in the sagittal plane. However, all these radiographic images may fail to accurately locate the malformation relative to adjacent unerupted teeth because of superimposition of adjacent structures.

This case report illustrates the benefits, in terms of treatment planning and surgical technique, of supplementing plain film radiographs with multidirectional cross-sectional tomography (MDCST) to localize a large maxillary odontome and accurately establish its relationship with an unerupted maxillary permanent central incisor.

Case report

A healthy Asian male, aged 7.5 years, was referred by his general dental practitioner to the Department of Paediatric Dentistry, Guy's Hospital, London, UK, for management of his retained maxillary right primary central and lateral incisors, and investigation of a large calcified radio-opaque mass overlying the roots of these primary teeth. The patient's mother was concerned about the asymmetrical appearance

Fig. 1. Photograph showing an anterior view of retained maxillary right primary central and maxillary right primary lateral incisors.

of his upper front teeth. The patient had no relevant medical history.

Extraoral examination was unremarkable. Intraoral examination revealed that the patient was in the early mixed dentition. The following teeth were present and healthy:

6 E D C B A | 1 2 C D E 6

6 E D C 2 1 | 1 2 C D E 6

(16; 55; 54; 53; 52; 51; 21; 22; 63; 64; 65; 26; 36; 75; 74; 73; 32; 31; 41; 42; 83; 84; 85; 46)

The maxillary right primary central and lateral incisors were not mobile, and there was a small but firm hard swelling overlying the buccal aspect of these teeth (Fig 1). The overlying buccal mucosa was red, but the tissues otherwise appeared normal. There was no evidence of a palatal swelling.

Fig. 3. Photograph of an upper standard occlusal radiograph showing a calcified mass associated with the unerupted maxillary right permanent central incisor.

A dental panoramic tomograph and an upper standard occlusal view revealed the presence of all the permanent teeth, except the third molars, and an irregular calcified radio-opaque mass with a lobular outline apical to the roots of the retained right primary maxillary central and lateral incisors (Figs 2 & 3). The radiographic appearance was consistent with a large complex odontome. The lesion was approximately 25×15 mm in size and extended up to the floor of the nasal cavity. The maxillary right permanent central incisor appeared to be part of or embedded within the mass. The permanent right lateral incisor had

Fig. 2. Photograph of a dental panoramic tomograph showing the presence of a large calcified mass in the upper premaxillary region and the presence of all the permanent teeth except the third molars.

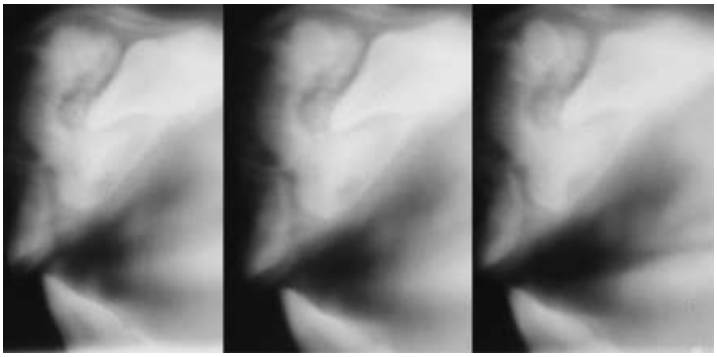

Fig. 4. (a–c) Mesial to distal photographs of Scanora® advanced cross-sectional tomographs at three different cuts in the sagittal plane depicting the U-shaped configuration of the calcified mass in relation to the unerupted maxillary right permanent central incisor.

been displaced distally and apically to the root of the upper right primary canine.

The plain film radiographs, however, failed to accurately diagnose the extent and location of the lesion in the sagittal plane, or its exact relationship to the unerupted right permanent central incisor. Therefore, it was decided to take three, 2-mm-thick MDCSTs (Scanora®, Soredex, Tuusula, Finland) of the anterior maxilla in the sagittal plane. This clearly revealed a large, but separate, calcified lobular U-shaped mass comprising two main bodies wrapping around the incisal aspect of the maxillary right permanent central incisor. This was consistent with a complex odontome overlying the buccal and palatal aspects of the unerupted maxillary right permanent central incisor (Fig. 4a–c). A provisional radiographic diagnosis of a complex odontome was made, and the patient was scheduled for surgical excision of the lesion. The information gained from the MDCST images allowed accurate surgical planning, thereby minimizing trauma to the developing permanent tooth.

Buccal and palatal mucoperiosteal flaps were raised between the maxillary right primary canine and the maxillary left permanent lateral incisor, and the calcified mass was removed in two sections, one from the buccal and one from the incisal-palatal aspect of the unerupted maxillary right permanent central incisor, leaving the tooth undisturbed. The palatal extent of the calcified mass, which was visible in the MDCST, matched the palatal extent of the hard tissue mass revealed at the time of surgery. Histological examination confirmed that the lesion was a complex odontome.

The patient was reviewed and soft tissue healing had taken place 4 weeks postoperatively. A partial denture was fitted to act as a space maintainer while monitoring the eruption of the maxillary right permanent central and lateral incisors, and the developing occlusion.

Discussion

The most common cause of failure of eruption of permanent central incisors in young patients is the presence of supernumerary teeth. These can usually be accurately located by taking plain films, such as a dental panoramic tomograph and an upper standard occlusal view, and applying the principle of vertical parallax technique, or using two intraoral radiographs and applying the rule of horizontal parallax. The plain film radiographs in this case revealed the presence of a large calcified mass overlying the maxillary unerupted permanent central incisor, but provided limited information regarding the exact relationship between the two. Techniques to overcome the shortcomings of plain film radiographs include linear tomography, computer-aided multidirectional tomography, computed tomography and cone beam computed tomography[8–10].

Low-dose equipment, such as the MDCST, has been developed for imaging the maxillofacial skeleton[11,12]. This utilizes computer-controlled spiral tomography to produce tomographic sections that are either tangential to the arch, progressing from the labial to lingual, or cross-sectional in the arch from the mesial to distal. This type of investigation is frequently used for implant assessment, examining the temporomandibular joint or maxillary antrum, as well as for expansive lesions within the jaws. The benefits of spiral cross-sectional tomography to

assist diagnosis and treatment planning for patients with impacted teeth, and those with failure of eruption caused by dilacerations, have also recently been reported[13–15].

In this case report, the plain view radiographs provided insufficient information regarding the exact relationship of the odontome to the underlying permanent central incisor. The spiral cross-sectional tomography precisely indicated that the odontome was U-shaped and comprised of two main bodies of calcified tissue, which wrapped around the incisal edge of, but were separate from, the upper right permanent central incisor, thus aiding the surgical planning and approach in this case. The dose to the patient (equivalent to three small periapical radiographs) from the additional radiographic procedure could be justified in this case since the information gained was of benefit in planning the surgical technique.

Histological examination revealed that the hard tissue mass comprised two homogenous masses with irregular pieces of dentine with multiple spaces within which there was pulpal tissue, enamel matrix, follicle and reduced enamel epithelium. This was consistent with a complex odontome[1], but its position in the anterior maxilla is unusual since complex odontomes are more common in the premolar and molar regions[2,3].

What this paper adds

- The importance of considering the presence of an odontome as a possible cause of bony expansion of the jaws and failure of eruption of permanent teeth in the mixed dentition.
- Multi directional low dose tomography allows visualisation of the precise relationship between the large complex odontome and the unerupted permanent incisor.

Why this paper is important to paediatric dentists

- The use of multi-directional cross-sectional images allowed for accurate surgical planning to remove the odontome.
- Accurate surgical planning can help minimise the trauma to the developing permanent teeth during surgical removal.

Conclusions

This case highlights the importance of considering the presence of an odontome as a possible cause of bony expansion of the jaws and failure of eruption of permanent teeth in the mixed dentition. The use of low-dose, multidirectional, cross-sectional tomography, in addition to the upper standard occlusal radiograph and dental panoramic radiograph had value in allowing visualization of the precise relationship between the large complex odontome and the unerupted permanent incisor in the sagittal plane, thus aiding the surgical management. Without tomography, it would have been impossible to make a correct judgement of the position on the odontome.

Acknowledgements

We wish to thank Professor Fraser McDonald, Department of Orthodontics, GKT Dental Institute, London, UK, for his advice and assistance with this case report.

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