Pyramidal teeth are thought to be a minor form of taurodontism, which is a morpho-anatomical change in the shape of a tooth, usually occurring in multirooted teeth as a result of failure of the infolding of the epithelial root sheet of Hertwig. The characteristic features of these teeth are an enlarged body and pulp chamber, as well as apical displacement of the pulpal floor. Endodontic treatment of a taurodont tooth is challenging, because it requires special care in handling, and in the identification of the number of root canals and morphology of the tooth. In this case report, the endodontic treatment of a mandibular first and second molar with pyramidal root canal morphology is presented.

Key words  

dental malformation, endodontic treatment, root canal morphology, taurodontism

Introduction

The term taurodontism was introduced in 1913 by Sir Arthur King[1]. He proposed that taurodont molars are characterised by the distinct extension of the pulp chamber below the level of the alveolar crest and the cementoenamel junction (CEJ), and apical displacement of the bi- or trifurcation of the roots. Additionally, taurodontism refers to a tooth-form characterised by an external block configuration, which means an elongated body that tends to enlarge at the expense of the root and give it a rectangular shape. Teeth with pulp chambers that are relatively small and have constriction of the pulp chamber at approximately the level of the CEJ are called cynodonts[2].

The aetiology of taurodontism is unclear, but is attributed to the failure of invagination of the epithelial root sheath sufficiently early to form the cynodont. One hypothesis is that taurodontism might be the result of a disrupted developmental haemostasis[3]. An autosomal transmission of the trait has also been observed[4]. Various manifestations of taurodontism are described: this malformation can occur alone, limited to one or more teeth or it can be associated with various syndromes including Down’s syndrome or Klinefelter’s syndrome[5,6]. Taurodontism may be unilateral or bilateral and affects permanent teeth more frequently than primary teeth. It is commonly observed among certain ethnic groups such as natives of Alaska, Australia and Central America[7].

Taurodontism may be classified as mild, moderate and severe (hypo-, meso- and hypertaurodontism, respectively)[8] based on the degree of apical displacement of the pulp chamber floor[2]. The prevalence of taurodontism found by radiographic dental examination in patients has been shown as ranging from 5.69 to 8%[9], up to 48% (18.8% of teeth affected)[10], or 60%[11], whereas the prevalence of pyramidal molars was 4.6% (1.6% of teeth) in specially selected ethnic groups[11]. In western European subjects, the prevalence is estimated to be about 10%[12,13]. Although taurodontism does not involve molar teeth exclusively[15] it is found to be significantly more prevalent in second maxillary molars[16].

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Endodontic treatment of two pyramidal (taurodont) mandibular molars: a case report

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Generally, taurodontism and pyramidal teeth are a rare dental anomaly, and endodontic treatment is challenging because it requires special care in handling and identifying the number of root canals17.

## Case report

### Diagnosis

A 43-year-old woman was referred to the author's department for the treatment of the right first mandibular molar. Dental history revealed that she had been suffering from pain for 6 days prior to her visit to the clinic and that the pain was spontaneous and aggravated at night. This was disturbing her sleep and meant she was taking analgesics. Tooth 46 had been endodontically pretreated 1 week previously and an intracanal dressing with Ledermix-paste (Riemser, Greifswald, Germany) was placed. This medicament consisted of corticosteroids and tetracycline. The corticosteroid component has a calming and anti-inflammatory effect, whereas the antimicrobial component should prevent the proliferation of bacteria.

Intraoral examination revealed that the coronal access cavity was sealed with a temporary filling. At tooth 47 a deep carious lesion was found on the mesio-occlusal surface. Both teeth were subjected to routine clinical tests and, although tooth 46 showed the typical symptoms for an endodontically pretreated tooth with Ledermix-paste (the sensitivity test was positive because of the remaining vital tissue, and the percussion test was negative), a provisional diagnosis of symptomatic irreversible pulpitis was made concerning tooth 47 (the sensitivity test was positive and the percussion test was positive). The periodontal probing depths showed no elevated levels.

Radiographic observations included an area of rarefaction located between the roots of both teeth, the carious lesion located at the mesial aspect of tooth 47, a kind of hypercementosis associated with the root of tooth 46 and a tendency of root canal obliteration (Fig 1). Moreover, the radiograph revealed an abnormal pyramidal root anatomy for both teeth.

### Endodontic treatment

Anaesthesia was achieved by means of inferior alveolar nerve block with 1.8ml of 4% articaine with 1:100,000 adrenaline. Access to the pulp chamber of tooth 47 was gained under rubber dam isolation. A huge pulp chamber was encountered with one central root canal. The pulp tissue was extirpated and the working length was determined electronically using the Root ZX device (Morita, Tokyo, Japan). Chemo-mechanical preparation of the root canal system was achieved by alternating circumferential filing with manual stainless steel K- and Hedström files at full working length. Copious irrigation with 2% sodium hypochlorite (NaOCl) was performed during the instrumentation process. Finally, after instrumentation was completed, a passive ultrasonic irrigation of the root canal was performed with NaOCl to ensure optimal dissolution of remaining pulp tissue. Using an operating microscope, no accessory apical canals were detected and a wide-open apical foramen was visible. A mechanical preparation up to ISO size 150 was necessary, because the first instrument that had bound in the apical region was already a size 110. At the same appointment, the pretreated tooth 46 was subjected to the same procedure after the coronal access was enlarged and the overhanging areas of the pulp chamber roof were removed. It was detected that the clinician had nearly caused perforation of the mesial (probably due to the exploration of the expected mesial canals during the previous appointment) but the absence of further root canals was proved using the operating microscope. The apical region was extremely calcified and a wide foramen could not be detected. Root canal instrumentation up to size 110 was thoroughly performed using circumferential filing with stainless steel K-files alternating with Hedström files, and repeated irrigation with NaOCl was performed after electronic determination of the working length. The root canals of both teeth were dried and dressed with an aqueous solution of calcium hydroxide (Ca(OH)$_2$). Finally, the access cavities were sealed with zinc oxide-eugenol cement.

The patient was recalled after 2 weeks. The intracanal dressing was removed with stainless steel hand instruments, and passive ultrasonic irrigation was performed to optimise the removal of the intracanal dressing. After thorough irrigation with NaOCl and EDTA for smear layer removal, the
canals were dried using paper points. Gutta-percha master cones were then fitted at working lengths with a slight tug-back. Obturation was performed using cold lateral condensation with a size 25 spreader and size 20 collateral points using AH Plus (Dentsply, Konstanz, Germany) as a sealer. After removing the surplus filling material and thorough cleaning of the access cavities, 37% phosphoric acid was syringed into both access cavities, left for 15s, rinsed off and a bonding agent was applied. Finally, both access cavities were sealed with a resin composite restoration. The post-operative radiograph shows homogeneous root canal fillings with an adequate length (Fig 2).

Post endodontic treatment

The patient was reviewed 3 months later and was free of symptoms. A new crown for tooth 46 was made. The 1-year follow-up radiograph revealed that healing had occurred (Fig 3). The radiograph that was subsequently made showed that all molars were characterised by the same root morphology (Fig 4).

Discussion

Taurodontism can occur in various forms, but depending on the severity of this malformation, a distinction in meso-, hypo-, hypertaurodontism or pyramidal teeth
has been suggested. The position of the pulpal floor in relation to the CEJ is the deciding factor. The prevalence of taurodont teeth varies within different populations, and the aetiology is not clear. Root morphology is primarily determined genetically, but may also be environmentally modified. The failure of sufficiently early invagination of the epithelial root sheath to form the cynodont, a disrupted developmental haemostasis and an autosomal transmission of the trait are aetiological factors of taurodont teeth that have been observed. Teeth most frequently affected are molars, although premolars and incisors have also been diagnosed as taurodonts in a radiographic study.

The incidence of taurodontism is variable, depending on the different series and groups studied. In general, molars and premolars in both the primary and permanent dentitions are affected. The occurrence of taurodontism associated with developmental disorders such as amelogenesis and dentinogenesis imperfecta, or hypodontia has been documented. In patients with syndromes such as Down’s syndrome, Klinefelter’s syndrome, ectodermal dysplasia syndrome, Mohr-syndrome, tricho-dento-osseous syndrome or in patients with cleft lip and palate, taurodont teeth are more prevalent than in healthy subjects.

In this particular case, the patient had no systemic disturbances, malformations or syndromes and, therefore, both teeth were considered to be non-syndromic taurodont teeth. Both teeth were classified as pyramidal teeth. An inheritable aetiology could not be found, as the families of the patients were not available for examination.

Endodontic treatment in taurodont teeth has been described as complex and difficult, because these teeth show wide variations in the size and shape of the pulp chamber with varying degrees of obliteration and canal configuration. This morphology could complicate the location of the canal orifices, which consequently causes difficulties in subsequent instrumentation and obturation.

The exploration of the canal configuration was done using an operating microscope because of the width of the pulp chamber. Some authors propose the use of micro-computerised tomography (micro-CT) to examine the morphology of difficult teeth. With this technique, three-dimensional information about the examined object is available for the planning of endodontic and surgical treatment. Some details may become visible that were not detectable using conventional examination methods. The radiation exposure depends on the CT and is much higher than with conventional intraoral radiographs. The indication for the diagnostic method should be evaluated carefully, and the ALARA-principle (as low as reasonably achievable) considered for the use of radiation.

Mechanical debridement and shaping of the root canals was achieved with circumferential filing using stainless steel hand K-files alternating with stainless steel hand Hedström-files, because the pulp chamber was huge. Preparing oval or large straight root canals by this technique leads to satisfying results and is superior to rotary instrumentation alone. An even preparation of all canal walls during the root canal instrumentation is possible using this circumferential filing technique. The root canal of tooth 47 was obturated by lateral condensation, as a wide apical foramen was present. This technique allows a good apical control by trial fitting the master cone, and the risk of overextension of gutta-percha or sealer is minimised. However, thermoplastic techniques are not well controlled and can lead to apical extrusion into the periapical tissue. This could cause post-operative complaints as well lead to a failure of the root canal treatment, or in the worst case, to an irreversible nerve injury if material is extruded into the nerve canal. Alternatively, an apical plug with mineral trioxide aggregate or apexification procedures using repeated Ca(OH)2 dressings would have been possible, but the chosen therapy was easy to handle and safe.

**Summary**

Taurodontism including all its varieties (meso-, hypo-, hypertaurodontism and pyramidal teeth) is a rare dental malformation, in which root canal treatment is still a challenge because of multiple and complex forms of canal configurations. In each case, radiographic examination is essential before initiating root canal treatment, so as to become aware of the particular root canal configuration. An operating microscope may be helpful for the exploration of further and accessory canals or a wide apical foramen. Chemo-mechanical preparation...
with copious irrigation and circumferential filing is necessary for successful endodontic treatment including the obturation technique, which allows good apical control, because wide foramina are among the characteristics of taurodont teeth.

References