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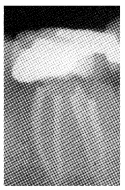

CASE REPORT

Nonsurgical endodontic management of a double tooth: a case report

K. Kremeier[1], O. Pontius[2], B. Klaiber[1] & M. Hülsmann[3]

[1]Department of Operative Dentistry and Periodontology, University of Würzburg, Würzburg; [2]Private practice, Bad Homburg; and [3]Department of Operative Dentistry, Preventive Dentistry and Periodontology, University of Göttingen, Göttingen, Germany

Abstract

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Aim To present a case with various morphological irregularities requiring root canal treatment and to discuss the problems and options for orthograde root canal treatment.

Summary Root canal treatment of a double tooth presenting with an acute alveolar abscess is described. The anatomical variations of this tooth included double tooth, dental invagination, incomplete apical closure, three root canal systems and an internal lacuna. The tooth was treated nonsurgically with orthograde root canal treatment resulting in nearly complete radiographic apical repair after 4 years.

Key learning points

- Double teeth occur infrequently and may be distinguished from fusion, gemination, concrescence and dental twinning.
- Several malformations may be present in a single tooth.
- Orthograde root canal treatment may be an adequate treatment option even in teeth with a complex internal anatomy.

Keywords: apical periodontitis, dens invaginatus, double tooth, fusion, gemination.

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Introduction

Traditionally, irregularities in the number and shape of teeth have been differentiated into gemination, fusion, twinning and concrescence (Tannenbaum & Alling 1963, Pindborg 1970). Classically, gemination is thought to present the incomplete attempt of one tooth germ to divide into two (Pindborg 1970). Geminated teeth demonstrate two crowns or one large partially separated crown sharing a single root or root canal. The most affected teeth are the permanent maxillary incisors and the deciduous mandibular incisors (Neville

Correspondence: Dr Karin Kremeier, Department of Operative Dentistry and Periodontology, University of Würzburg, Pleicherwall 2, 97070 Würzburg, Germany (Tel.: +49 931 201 72500; fax: +49 931 201 72400; e-mail: kremeier_k@klinik.uni-wuerzburg.de).

et al. 1999). Fusion (synodontia or false gemination) is defined as a union between the dentine of two or more teeth, which may be complete or partial and results in a reduced number of teeth in the dental arch (Tannenbaum & Alling 1963). Twinning (schizodontia) has been used as a synonym for gemination but actually it means that cleavage of the tooth bud is complete. This results in the formation of an extra tooth which is usually a mirror image of its adjacent partner. The union of a supernumerary tooth and a normal tooth is referred to as diphyodontic gemination or odontoma (Tannenbaum & Alling 1963). Concrescence is defined as the union of two completely separate teeth which are joined only by their cementum after formation of crowns (Tannenbaum & Alling 1963, Pindborg 1970). Supernumerary teeth are teeth additional to those of the normal series. They develop most frequently in the anterior and molar region of the maxilla followed by the premolar region of the mandible with a prevalence of about 1–3% of the population in the permanent dentition (Schulze 1970, Soames & Southam 1998). A mesiodens is a supernumerary tooth developing between the maxillary incisors and is the most common type of a supernumerary tooth (Soames & Southam 1998).

Dens invaginatus (dens in dente, dilated composite odontoma) represents a dental anomaly, characterized by invagination of the enamel organ (Pindborg 1970) and resulting in a wide range of complex anatomical variations (Hülsmann 1997). A deep foramen coecum may indicate the presence of an invaginated tooth (Pindborg 1970, Jung 2004). Some case reports underline the assumption that structural defects with incomplete enamel lining in the depth of invagination pits (Oehlers 1957) support early development of caries, subsequent pulp necrosis, and also abscess and cyst formation (Neville *et al.* 1999, Girsch & McClammy 2002). Controversially, Gotoh *et al.* (1979) demonstrated that lesions of endodontic origin in most cases are caused by approximal caries and not by caries in the depth of the invagination. A histological study of undemineralized invaginated teeth was not able to show the presence of channels or soft tissue connections between the invagination and the pulp (Piattelli & Trisi 1993).

The incidence of dens invaginatus has been reported to be in a range between 0.04% and 10%, with the maxillary lateral incisors being the most commonly involved teeth. Bilateral occurrence is observed in 42% of those cases (Hovland & Block 1977, Rotstein *et al.* 1987). Supernumerary teeth often present invaginations (Pindborg 1970). A widely used classification to characterize the extent of malformation associated with dens invaginatus has been presented by Oehlers (1957). In type I, the invagination, which is enamel-lined, is confined within the tooth crown. In type II, the enamel-lined invagination extends into the root but remains confined as a blind sac; however, communication with the pulp is possible and the invagination can be dilated. In type III, the invagination penetrates the root and forms an additional lateral or apical foramen (Oehlers 1957). Numerous case reports have been published demonstrating the enormous variety of anatomic variations in such teeth (Hülsmann 1997). If pulpitis or pulp necrosis occur endodontic treatment may present a challenge because of these variations in tooth anatomy: preparation of an adequate access cavity may present a challenge as well as location and instrumentation of one or more complex or even bizarre root canal systems. Difficulties in instrumentation, disinfection and filling, often in combination with incomplete root development, in some cases can render surgical or combined endodontic-surgical treatment the preferable treatment option.

A case report

A 27-year-old male consulted the dental clinic complaining of pain and swelling in the maxillary left anterior region. The patient's medical history was noncontributory. Additionally, there was no history of orofacial trauma. The patient reported that there

had always been problems and functional disturbance, with his malformed incisor requiring orthodontic therapy years previously. Clinical examination revealed swelling and tenderness associated with the maxillary left central incisor that had a composite resin restoration of unusual width (Fig. 1). The palatal aspect of the crown looked similar to a talon cusp and was restored with composite resin in the area of the cingulum (Fig. 2). The patient reported that the cusp had been ground down repeatedly because of interference with the occlusion. Probing depths were 3 mm or less and there was only slight mobility. The tooth exhibited severe sensitivity to percussion and palpation, and was unresponsive to thermal pulp testing. Teeth 12, 11 and 22 gave normal responses to percussion, palpation and vitality testing. Tooth 11 had no signs of alterations, but teeth 12 and 22 had marked depressions on their palatal aspects near the cingulum (Fig. 2). A periapical radiograph revealed aberration of the root anatomy of tooth 21 and a large periapical radiolucency. Teeth 12 and 22 had signs of enamel invaginations.

Radiographic examination (Fig. 3) suggested the following diagnosis: fusion, caused by the union of the left central incisor and a supernumerary tooth or fusion, caused by the union of the left central incisor and a mesiodens with a dens invaginatus ending as a blind sac. Additionally, multiple canal systems, large foramina, diffuse external lateral root resorption and internal root resorption were diagnosed.

The diagnosis highlighted that tooth 21 was a double tooth with a necrotic pulp demonstrating a chronic apical periodontitis undergoing acute exacerbation (phoenix abscess). Tooth 12 had a dens invaginatus Oehlers' type I and tooth 22 a dens invaginatus type II.

The patient was informed about the complex anatomy of the root, therapeutic options and possible complications. A decision was made to perform orthograde root canal

Figure 1 The maxillary left central incisor presented a composite resin restoration of unusual width.

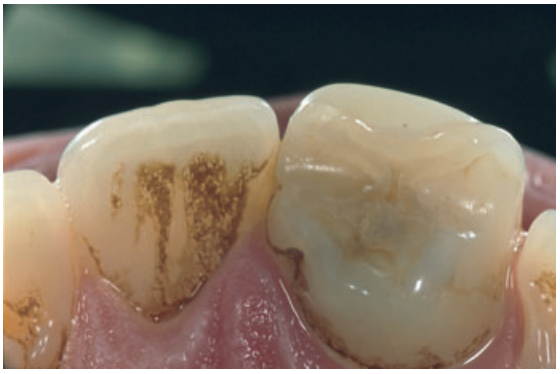

Figure 2 The palatal aspect seemed to be similar to a talon cusp.

Figure 3 Pre-operative periapical radiograph showing tooth 21 with a large periapical radiolucency and complex root canal anatomy including several malformations.

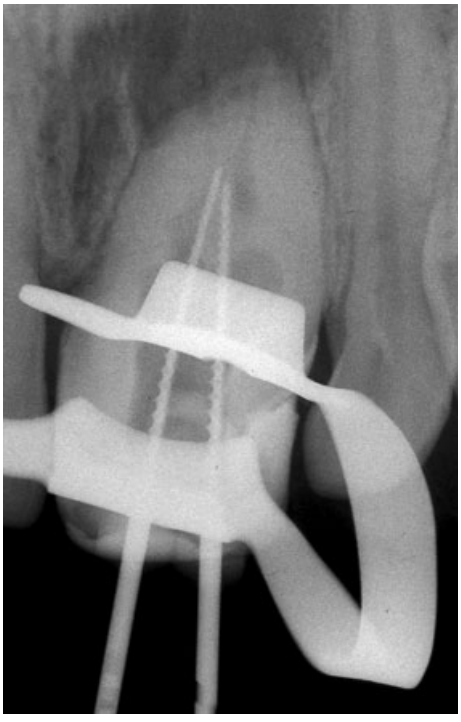

Figure 4 Radiographic working length determination.

treatment. An endodontic access cavity was prepared after isolation with rubber dam. Two main canals (one buccal and one palatal) and one irregular canal, which seemed to widen into an internal resorption cavity were identified. Upon access into the palatal canal, there was a purulent discharge, which was allowed to drain. With the aid of a dental

Figure 5 Radiographic verification of the obturation.

Figure 6 At the 4-year recall radiographic periapical repair was nearly complete.

operating microscope (Zeiss, OPMI 111, Oberkochen, Germany), the irregular disto-palatal canal was enlarged and it was possible to observe the smooth floor of the 'resorption cavity'. Working length of the root canals was determined using an apex locator (Root ZX, Morita Europe, Dietzenbach, Germany), paper points and a radiograph (Fig. 4). After cleaning and shaping the root canal systems and irrigation with 5% sodium hypochlorite, the root canals were dressed with calcium hydroxide and the tooth was sealed temporarily with intermediate restorative material (IRM, Dentsply DeTrey, Konstanz, Germany). The

apical swelling completely subsided after 2 weeks, but after removing the calcium hydroxide paste, serous exudate still discharged from the palatal canal. After thorough irrigation with 5% sodium hypochlorite, calcium hydroxide was again placed into the canals and the patient was asked to return after 2 weeks. At the third appointment, the root canals remained dry after removing the calcium hydroxide and copious irrigation. Following radiographic control of the cone fit (Autofit, Sybron Endo, Glendora, CA, USA), the apical portions of the main root canals were obturated with vertically compacted warm gutta-percha using the System B device (EIE Analytic, Orange, CA, USA). The coronal parts of the main canal and the invagination were back filled with the Obtura gun (Obtura II, Spartan, Fenton, MO, USA) (Fig. 5). The access cavity was sealed with light-cured composite resin (Tetric Ceram, Vivadent AG, Schaan, Liechtenstein).

The patient returned every 6 months for clinical and radiographic follow-ups. Evidence of periapical repair was observed after 18 months. At the four-year recall periapical repair was nearly complete (Fig. 6).

Discussion

The aetiology of teeth with developmental malformations such as a double tooth has been discussed controversially (Brook & Winter 1970, Killian & Croll 1990, Soames & Southam 1998, Neville *et al.* 1999). It is difficult to decide whether fusion or gemination has occurred in a given case, because the double tooth could have arisen from a split of a single tooth germ or fusion between a normal tooth germ and that of a supernumerary tooth (Mader 1979). As the aetiology remains unclear, the current literature recommends the term 'double' or 'connated' tooth (Soames & Southam 1998, Neville *et al.* 1999). In fact, Brook & Winter (1970) had already recommended the neutral 'double tooth' to describe both anomalies, whilst Killian & Croll (1990) suggested 'dental twinning' as a basic diagnostic term for all joining defects.

The prevalence of fusion and gemination varied from 0.1% to 1% for both dentitions in a retrospective study that reviewed the early literature (Brook & Winter 1970). Buenviaje & Rapp (1984) examined 2439 children, ranging in age between 2 and 12 years and found fused teeth in 0.42% and geminated teeth in 0.08% of the cases, whereas supernumerary teeth occurred in 0.45%. In another study on Jordanian adults, the occurrence of fused or geminated teeth has been reported to be 0.19% and 0.22%, respectively (Hamasha & Al-Khateeb 2004).

As a double tooth is a rare malformation, the general dental practitioner should be prepared to meet unusual chamber and canal morphology when performing root canal treatment (Spatafore 1992). The unique morphology generates difficulties when accessing the pulp canal systems, determining working length(s) and managing large foramina during filling of the root canal.

The use of a dental-operating microscope is beneficial for visualization and treatment of such anomalies. Although the radiograph in the present case suggested no enamel-lined invagination, the microscopic view showed a smooth surface of the internal cavity less likely as a result of internal resorption but similar to a blind sac of a dens invaginatus type II (Girsch & McClammy 2002).

The management of the complex root canal system of this case resembles the one reported by Mangani & Ruddle (1994).

For better aetiologic understanding of this case, efforts were made to gain access to the patient's orthodontic treatment records and models. Figures 7 and 8 show the study models used during the orthodontic treatment of the patient at an early age. They support the assumption that fusion of a geminated central incisor with a palatal mesiodens had occurred. The grinding of the palatal mesiodens because of functional discrepancy was

Figure 7 Orthodontic study models showing tooth 21 before restorative treatment.

Figure 8 Palatal view of orthodontic study model supports the assumption of fusion with a mesiodens.

most likely the reason for pulp necrosis and acute periradicular abscess formation following dentinal exposure of the mesiodens and subsequent pulp infection.

Conclusion

The occurrence of a double tooth in general dental practice may be rare, but the dentist should be aware of the nature of the problems encountered and the specific treatment needs, particularly concerning access, orthograde cleaning, shaping and canal filling. Nonsurgical orthograde root canal treatment should be considered as an adequate treatment option even in teeth with complex malformations.

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References

Brook AH, Winter GB (1970) Double teeth: a retrospective study of 'geminated' and 'fused' teeth in children. *British Dental Journal* **129**, 123–30.

Buenviaje TM, Rapp R (1984) Dental anomalies in children: a clinical and radiographic survey. *ASDC Journal of Dentistry for Children* **51**, 42–6.

Girsch WJ, McClammy TV (2002) Microscopic removal of dens invaginatus. *Journal of Endodontics* **28**, 336–9.

Gotoh T, Kawahara K, Imai K, Kishi K, Fuyiki Y (1979) Clinical and radiographic study of dens invaginatus. *Oral Surgery, Oral Medicine, and Oral Pathology* **48**, 88–91.

Hamasha AA, Al-Khateeb T (2004) Prevalence of fused and geminated teeth in Jordanian adults. *Quintessence International* **35**, 556–9.

Hovland EJ, Block RM (1977) Nonrecognition and subsequent endodontic treatment of dens invaginatus. *Journal of Endodontics* **3**, 360–2.

Hülsmann M (1997) Dens invaginatus: aetiology, classification, prevalence, diagnosis, and treatment considerations. *International Endodontic Journal* **30**, 79–90.

Jung M (2004) Endodontic treatment of dens invaginatus type III with three root canals and open apical foramen. *International Endodontic Journal* **37**, 205–13.

Killian CM, Croll TP (1990) Dental twinning anomalies: the nomenclature enigma. *Quintessence International* **21**, 571–6.

Mader CL (1979) Fusion of teeth. *Journal of the American Dental Association* **98**, 62–4.

Mangani F, Ruddle CJ (1994) Endodontic treatment of a 'very particular' maxillary central incisor. *Journal of Endodontics* **20**, 560–1.

Neville BW, Damm DD, White DK (1999) *Color Atlas of Clinical Oral Pathology*, 2nd edn. Baltimore, USA: Lippincott Williams & Wilkins, pp. 58–66.

Oehlers FA (1957) Dens invaginatus (dilated composite odontome). I. Variations of the invagination process and associated anterior crown forms. *Oral Surgery, Oral Medicine, and Oral Pathology* **10**, 1204–18.

Piattelli A, Trisi P (1993) Dens invaginatus: a histological study of undemineralized material. *Endodontics and Dental Traumatology* **9**, 191–5.

Pindborg JJ (1970) *Pathology of the Dental Hard Tissues*. Copenhagen: Munksgaard, pp. 30–64.

Rotstein I, Stabholz A, Heling I, Friedman S (1987) Clinical considerations in the treatment of dens invaginatus. *Endodontics and Dental Traumatology* **3**, 249–54.

Schulze CC (1970) Developmental abnormalities of the teeth and jaws. In: Gorlin RJ, Goldman HM, eds. *Thoma's Oral Pathology*, Vol. I. St Louis, USA: Mosby, pp. 108–18.

Soames JV, Southam JC (1998) *Oral Pathology*, 3rd edn. Oxford, New York, Tokyo: Oxford University Press, pp. 6–7.

Spatafore CM (1992) Endodontic treatment of fused teeth. *Journal of Endodontics* **18**, 628–31.

Tannenbaum KA, Alling EE (1963) Anomalous tooth development: case reports of gemination and twinning. *Oral Surgery, Oral Medicine, and Oral Pathology* **16**, 883–7.