CASE REPORT

Dens invaginatus in a geminated maxillary lateral incisor

Renjith George Pallivathukal,¹ Alok Misra,² Sumanth Kumbargere Nagraj,³ Preethy Mary Donald³

¹Faculty of Dentistry, Department of Oral Pathology, Melaka-Manipal Medical College, Melaka, Melaka, Malaysia

²Faculty of Dentistry, Department of Conservative and Endodontics, Melaka-Manipal Medical College, Melaka, Malaysia

³Faculty of Dentistry, Department of Oral Medicine, Oral Diagnosis and Oral Radiology, Melaka-Manipal Medical College, Melaka, Malaysia

Correspondence to

Dr Renjith George Pallivathukal, drrenjithgeorgep@gmail.com

Accepted 2 May 2015

SUMMARY

Dens invaginatus (DI) and gemination are two developmental abnormalities that are well reported in the dental literature, but their coexistence in a single tooth is rare. Such situations worsen the risk factors associated with these anomalies, and the treatment plan should be customised as they possess altered morphology and anatomy. A 19-year-old girl came for evaluation of a cracked tooth in the front region of the upper jaw. The tooth showed clinical features of gemination and radiographic features of DI, and was diagnosed as DI in geminated maxillary lateral incisor. The differential diagnoses based on clinical appearance without radiographic investigation may warrant the treatment approach if these two abnormalities coexist in a single tooth. The report also highlights the importance of three-dimensional imaging in diagnosis and treatment planning of teeth with altered pulp canal anatomy. There are few reported cases in the literature detailing the treatment options for these two anomalies occurring in the same tooth.

BACKGROUND

Concomitant occurrence of dens invaginatus (DI) and gemination is extremely rare, and there are few reported cases in the literature. We report a case of DI in a geminated maxillary lateral incisor.

CASE PRESENTATION

A 19-year-old girl presented with a cracked tooth in the front region of the upper jaw. Clinical examination revealed #22 with a central groove on the labial surface dividing the crown into mesial and distal halves (figure 1). The groove continued on to the palatal surface, which ended near the composite restoration, from earlier dental work, on the palatal surface. There was pinkish discolouration on the labial surface, in the middle third of the crown. The tooth (#22) was comparatively larger in mesio-distal dimension when compared with #12. The tooth was not associated with pain and was non-tender on percussion. The patient's history was unremarkable, and especially so for trauma. Previous dental history revealed she had undergone composite restoration of the pit on the palatal surface of #22 as a part of routine dental prophylaxis. A year later she developed pain in the tooth and associated area. She did not seek dental treatment but the pain subsided with antibiotics and analgesics.

Figure 1 Clinical picture showing bifid crown with central groove extending up to the cervical region.

INVESTIGATIONS

The tooth was not tender on percussion and electric pulp testing proved it non-vital. Radiographic examination revealed an invagination lined by enamel-like radiodensity, reaching up to the apical foramen, but without communication to the pulp chamber (figures 2 and 3). There was an associated radiolucent lesion at the periapical region measuring 2×1.5 cm, and radiographic provisional diagnosis of periapical granuloma was assigned. Cone beam CT (CBCT) images (Planmeca Promax 3Ds, Helsinki, Finland) showed no communication between the invagination and the pulp chamber, but the invagination opened up apically near the foramen and communicated with the periodontal ligament space (figures 4 and 5). Axial CBCT section at different levels revealed the pulp canal anatomy and the location of calcified structures within the pulp chamber (figures 6–8).

DIFFERENTIAL DIAGNOSIS

Clinically, the tooth appeared to be fractured, but there was no history of trauma. Comparatively increased mesiodistal width and bifid appearance of the crown were suggestive of gemination. The patient had a total of 30 teeth, with a history of extraction of #18 and #28. Fusion was excluded based on this observation. The restoration on the palatal surface and the patient's dental history indicating the presence of a lingual pit (for which the restoration was performed) pointed towards DI. DI involves the palatal surface of maxillary incisors leading to development of a deep lingual pit. The radiographic imaging showed the invagination extending past the CEJ and opening up apically near the foramen, and communicating with the periodontal ligament space; it was diagnosed as DI (type 3 B). DI occurs due to invagination of enamel organ into the dental papilla prior to calcification.¹

CrossMark

To cite: Pallivathukal RG, Misra A, Nagraj SK, et al. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2015-209672

Figure 2 Intraoral periapical (IOPA) radiograph showing dens invaginatus dividing the pulp chamber into two mesial and distal portions, which are connected in the apical region. Periapical radiolucency suggestive of periapical pathology can also be seen.

But in case of gemination, it leads to development of grooves on the labial surface, which extend to the palatal surface of the crown.² Both abnormalities can be differentiated by the radiographic finding of invagination lined by enamel-like radiodensity in cases of DI. But in this case, the tooth showed clinical features of gemination and radiographic features of DI. The condition was diagnosed as DI (type 3 B) in geminated (type 1) maxillary left lateral incisor.

TREATMENT

Once the dens in dente was identified along with the periapical radiolucency in tooth #22, an orthograde endodontic treatment to heal the periapical infection conservatively was planned. An access opening was made following standard operating protocol for the tooth. The dens part was approached first, but it proved difficult to access. It was decided to cut through the dens,

Figure 3 Panoramic radiograph showing dens invaginatus in relation to #22. Note the increased mesiodistal width of #22 in comparison to #12.

Figure 4 Cone beam CT (CBCT) image (sagittal and coronal view) confirming the diagnosis of dens invaginatus (type 3B).

following the access cavity, to gain access to the main pulp space, which was now largely occupied by the dens. Once accessibility was established, the pulp space could be accessed up to the apical area. The lateral space between the main pulp space and outer surface of the dens was still not readily accessible. The pulp space was unusually wide due to the dens, and thus it required minimal preparation. Thorough and copious irrigation was carried out with normal saline followed by sodium hypochlorite 0.5% solution. Glide paste (EDTA) was also used to remove the calcified material from the access opening, which was identified during the access-opening procedure. The glide was applied only for a brief duration and in minimal quantity. It was thoroughly flushed out later with normal saline.

Figure 5 Cone beam CT (CBCT) image (sagittal and coronal view) confirming the diagnosis of dens invaginatus (type 3B).

Figure 6 Axial section at mid-coronal region of #22, showing prominent pulp chamber and restorative material.

A surgical approach was planned keeping in view the difficulty of accessing the lateral walls using an orthograde approach. A trapezoidal flap was raised and the surgical site was exposed following the standard operating procedure for apicoectomy. The periapical radiolucent area was readily accessed because of fenestration of the buccal plate of the maxillary bone. The apical end appeared to be open. The pulp space was thoroughly irrigated and dried using paper points, and Glass Ionomer-based endodontic sealer (GC Corporation) was introduced through the coronal access until it overflowed through the apical end. A fibreglass post (FRC Postec Plus, Ivoclar Vivadent) was inserted within this Glass Ionomer central filling to help strengthen the tooth, which showed an unusually wide dimension in the middle third. The over flown Glass Ionomer also helped to seal the apical end of the root, as it would do in a retrofilling, following the periapical surgery. The coronal access was restored with flowable composite resin restorative (Filtek Z350 XT from 3M ESPE Co) to help provide a bonded restoration for the access cavity.

Figure 7 Axial section at the junction of crown and root of #22, showing the oval radiopaque structure in the centre of the pulp suggestive of 'dens invaginatus'.

Figure 8 Axial section at the apical one-third of root of #22, showing enlarged pulpal space.

The shallow surgical bony crypt in the periapical area showed a bone bleeder that was promptly sealed using bone wax, and surgical cellulose was filled into the bony crypt to avoid a later bleeding episode in the area. Interrupted mattress sutures in 3-0 black silk were placed over the flap. After 1 week, the sutures were removed and the patient was discharged. A postoperative radiograph was taken to verify the status of the pulp space obturation and periapical area.

OUTCOME AND FOLLOW-UP

The patient was re-examined after 1 week; the gingival soft tissues showed good healing and a symptom free #22 was observed. The patient was recalled for follow-up after 6 months. Follow-up radiograph revealed remission of the periapical pathology and the tooth was asymptomatic (figure 9). No evidence of any exudate or tenderness could be found, so the patient was scheduled for fabrication of a complete coverage full ceramic crown to restore aesthetics. Completion of crown placement has been planned. Meanwhile, the tooth has a temporary crown in place.

DISCUSSION

DI is a developmental anomaly, occurring during permanent tooth development, leading to a deep surface invagination of the crown or root that is lined by enamel. This may develop due to an infolding of epithelial structure of enamel organ into the dental papilla, before the calcification of the crown. The commonly involved teeth are maxillary permanent lateral incisors followed by central incisors and premolars.^{1 3 4} The frequency of occurrence of DI ranges from 0.04% to 10%, with a female to male ratio of 3:1.^{1 5}

Clinically, it manifests as a deep lingual pit and may be filled with soft tissues similar to dental follicle, which become necrotic after eruption. Food debris is easily lodged in the deep groove and can increase the risk of caries development due to difficulty in cleaning the area.^{1 3} The depth of the invagination varies from an enlarged lingual pit to a deep invagination extending to the apex. Oehlers classified DI based on the degree of invagination.⁶

Type 1: confined to crown

Type 2: extending below the cemento-enamel junction and ending in a blind sac that may or may not communicate with the adjacent dental pulp

Figure 9 Follow-up radiograph after 6 months, showing remission of the periapical pathology.

Type 3: extending through the root and perforating the lateral (type 3A) or apical (type 3 B) radicular area without any immediate communication with the pulp.

There are other classifications of DI in the literature (Ulmansky and Hermel,⁷ Vincent-Townend,⁴ and Schulze and Brand⁸), but Oehler's classification is widely accepted for its simplicity and ease of practical application.^{9–10} The types of DI vary in frequency of occurrence with type 3 being the rarest, comprising 5%, compared to type 1 (79%) and type 2 (15%).^{9–11}

DI is usually an incidental finding on the radiograph, with a deep lingual pit in the case of incisors. Two-dimensional radiographs will assist in determining the severity and type of DI, but they are of limited use in understanding the complex root canal morphology in DI cases. Apart from this, the difficult access to the primary pulp canal makes it challenging for the clinician.^{12–13} Advanced imaging, such as spiral CT (SCT) or CBCT, reveals the complex root morphology, and examination of the anatomy of pulp canals increases the accuracy of diagnosis; also, providing a three-dimensional image helps the clinician to deliver the treatment procedure more precisely. These imaging techniques provide a three-dimensional view of the DI along with accurate morphology of root canals and typing of DI. Three-dimensional imaging is also useful in detecting the communication between the invagination and the primary root canal.^{14–16}

The easy access of bacteria and irritants to the pulp mandate the treatment for DI at the earliest.¹⁷ Treatment of DI depends on the severity of malformation and the stage at the time of diagnosis. It varies from simple prophylactic restoration or root canal treatment, to surgical intervention. Treatment can be prophylactic restoration only if detected at a very early stage. In the present case, prophylactic restoration was carried out based on the patient's dental history. But the communication with the

periapical tissues, which is a feature of type 3 DI, led to the periapical lesion. The clinician should have suspected DI and identified the type of DI before proceeding with the treatment. The second option, Root Canal Treatment (RCT), is dependent on the type of DI. RCT can be limited to the invagination, preserving pulp vitality,¹⁸ or removal of the DI followed by RCT.^{19–20} The third option, in cases of DI that are difficult to access, is apicectomy of the involved tooth followed by RCT.^{21–22} Extraction is the last measure of treatment in cases with a complex anatomy and those that cannot be treated endodontically or with periapical surgery.¹²

Gemination is defined as an attempt of a single tooth bud to divide, with the resultant formation of a tooth with a bifid crown and usually a common root canal. The normal count of the teeth is maintained when the anomalous tooth is counted as one. This feature is important to differentiate between gemination and fusion, where the latter will have one tooth less than the normal count when the anomalous tooth is counted as one.^{1–23} Prevalence of gemination and fusion ranges from 0.3% to 0.5%, and 0.5% to 2.5%, in permanent and deciduous dentition, respectively. Incisors and canines are most commonly affected in both the dentitions. A maxillary arch is predicted for gemination and mandibular arch for fusion.¹

The common presentation of gemination is two completely or incompletely separated crowns with a single root and root canal.^{1–3} Aguilo *et al*²⁴ classified the condition as follows:

Type 1: bifid crown with single root

Type 2: large crown with a large root

Type 3: two fused crowns with a single root

Type 4: two fused crowns with two fused roots

Gemination can occur in both deciduous and permanent dentition, with a higher frequency in the maxillary arch. Most commonly involved teeth are incisors and canines in both dentitions. Clinically, the affected tooth appears as an enlarged or joined tooth with a bifid crown. Usually, the tooth shows labial and lingual grooves, and the radiograph will show a common root and root canal.^{1–3–4} Accumulation of bacterial plaque in the deep labial and lingual grooves can lead to periodontal complications, especially when they extend subgingivally. In the presented case, the labial and palatal grooves ended near the cervical third of the crown without any obvious periodontal involvement in the cervical region. Accumulation of debris and bacterial plaque can also lead to caries development if strict oral hygiene measures are not followed. Gemination will have an impact on aesthetics, as the individual tooth morphology is altered, depending on the type and also on occlusion. Treatment of a geminated tooth often demands a multidisciplinary approach for the same reason.²⁵ The treatment options depend on the type of gemination and associated complications due to the anomaly. They range from simple prosthetic rehabilitation and resizing of crowns to extraoral hemisection and immediate reimplantation.²⁶ In the present case, the grooves did not extend subgingivally and did not cause any periodontal pathology. Caries also was not detected in relation to the labial groove. But the lingual groove possibly continued with the invagination, which was not evident due to previous restorative treatment and restoration in the lingual pit. The patient was concerned about the disproportional size of the tooth and the unpleasant grooves on its labial surface. After treating the DI and periapical pathology, a single unit crown was planned to restore the aesthetics in this case.

Concomitant occurrence of DI with other dental anomalies, malformations and syndromes have been reported in the literature.^{12–13} There are only a few reported cases of concomitant

occurrence of gemination and DI by Burzynski,²⁷ Mader,²⁸ Nazif and Laughlin,²⁹ and Canger *et al.*³⁰ The differential diagnoses based on clinical appearance without radiographic investigation may warrant the treatment approach if these two abnormalities coexist in a single tooth. Such situations also worsen risk factors associated with these anomalies.

Learning points

- Rarely, dens invaginatus (DI) can occur in a geminated tooth.
- Clinical features of bifid crown, labial and lingual groove, deep lingual pit in anterior tooth and radiographic features showing invaginations lined by enamel-like radiodensity, is suggestive of concomitant occurrence of DI and gemination.
- Clinician should think of DI and do further radiographic examination while examining a tooth that presents with clinical symptoms of pulpitis without evidence of caries, trauma or periodontal pathology.
- Three-dimensional imaging will aid in identifying the type of DI, which will help the clinician to modify the treatment procedure.

Acknowledgements The authors thank Professor Abdul Rashid Haji Ismail, Dean, Faculty of Dentistry, for his support and encouragement in reporting the case, and the management sector of Melaka-Manipal Medical College, for providing state-of-the-art facilities in their Department of Oral Radiology. They also thank the Department of Oral Surgery for all the effort in completion of the treatment.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

- 1 Neville BW, Damm DD, Allen CM, *et al.*, eds. Abnormalities of teeth. In: *Oral and maxillofacial pathology*. St. Louis, Missouri: Saunders Elsevier, 2009:84–5.
- 2 Purani JM, Purani HJ. A rare presentation of multiple dens invaginatus in maxillary dentition. *BMJ Case Rep* 2014;2014:bcr-2013-200389.
- 3 Rajendran R, Sivapathasundharam B. eds. *Shafer's textbook of oral pathology*. 7th edn. Elsevier, 2012:40.
- 4 Vincent-Townend J. Dens invaginatus. *J Dent* 1974;2:234–8.
- 5 Hovland EJ, Block RM. Non-recognition and subsequent endodontic treatment of dens invaginatus. *J Endod* 1977;3:360–2.
- 6 Oehlers F. Dens invaginatus (dilated composite odontome). *Oral Surg Oral Med Oral Pathol* 1957;10:1204–18.
- 7 Ulmansky M, Hermel J. Double dens in dente in a single tooth. *Oral Surg Oral Med Oral Pathol* 1964;17:92–7.
- 8 Schulze C, Brand E. Dens invaginatus (dens in dente). *ZWR* 1972;81:569–73, 613–20, 653–60, 699–703.
- 9 Kallianpur S, Sudheendra U, Kasetty S, *et al.* Dens invaginatus (type III B). *J Oral Maxillofac Pathol* 2012;16:262–5.
- 10 Alani A, Bishop K. Dens invaginatus. Part 1: classification, prevalence and aetiology. *Int Endod J* 2008;41:1123–36.
- 11 Ridell K, Mejäre I, Matsson L. Dens invaginatus: a retrospective study of prophylactic invagination treatment. *Int J Paediatr Dent* 2001;11:92–7.
- 12 Hulsman M. Dens invaginatus: etiology, classification, prevalence, diagnosis and treatment consideration. *Int Endod J* 1997;30:79–90.
- 13 Ballal S, Sachdeva GS, Kandaswamy D. Endodontic management of a fused mandibular second molar and paramolar with the aid of spiral computed tomography: a case report. *J Endod* 2007;33:1247–51.
- 14 Reddy YP, Karpagavinayagam K, Subbarao CV. Management of dens invaginatus diagnosed by spiral computed tomography: a case report. *J Endod* 2008;34:1138–42.
- 15 Kfir A, Telishevsky-Strauss Y, Leitner A, *et al.* The diagnosis and conservative treatment of a complex type 3 dens invaginatus using cone beam computed tomography (CBCT) and 3D plastic models. *Int Endod J* 2013;46:275–88.
- 16 Zubizarreta Macho Á, Ferreira A, Rico-Romano C, *et al.* Diagnosis and endodontic treatment of type II dens invaginatus by using cone-beam computed tomography and splint guides for cavity access: a case report. *J Am Dent Assoc* 2015;146:266–70.
- 17 de Souza SMG, Bramante CM. Dens invaginatus: treatment choices. *Endod Dent Traumatol* 1998;14:152–8.
- 18 Schwartz SA, Schindler WG. Management of a maxillary canine with dens invaginatus and a vital pulp. *J Endod* 1996;22:493–6.
- 19 Jung M. Endodontic treatment of dens invaginatus type III with three root canals and open apical foramen. *Int Endod J* 2004;37:205–13.
- 20 Shadmehr E, Kiaani S, Mahdavian P. Nonsurgical endodontic treatment of a maxillary lateral incisor with dens invaginatus type II: a case report. *Dent Res J (Isfahan)* 2015;12:187–91.
- 21 Sauveur G, Roth F, Sobel M, *et al.* Surgical treatment of a periradicular lesion on an invaginated maxillary lateral incisor (dens in dente). *Int Endod J* 1997;30:145–9.
- 22 Fröner IC, Rocha LF, da Costa WF. Complex treatment of dens invaginatus type III in maxillary lateral incisor. *Endod Dent Traumatol* 1999;15:88–90.
- 23 Rao P, Veena K, Chatra L, *et al.* Twin tooth on either side: a case report of bilateral gemination. *Ann Med Health Sci Res* 2013;3:271–3.
- 24 Aguiló L, Gandia J, Cibrian R, *et al.* Primary double teeth. A retrospective clinical study of their morphological characteristics and associated anomalies. *Int J Paediatr Dent* 1999;9:175–83.
- 25 Türkaslan S, Gökçe HS, Dalkız M. Esthetic rehabilitation of bilateral geminated teeth: a case report. *Eur J Dent* 2007;1:188–91.
- 26 Tuna EB, Yildirim M, Seymen F, *et al.* Fused teeth: a review of the treatment options. *J Dent Child (Chic)* 2009;76:109–16.
- 27 Burzynski N. Gemination and dens in dente. *Oral Surg Oral Med Oral Pathol* 1973;36:760–1.
- 28 Mader C. Double dens in dente in a geminated tooth. *Oral Surg Oral Med Oral Pathol* 1979;47:573.
- 29 Nazif MM, Laughlin DF. Dens invaginatus in a geminated central incisor: case report. *Pediatr Dent* 1990;12:250–2.
- 30 Canger EM, Celenk P, Sezgin OS. Dens invaginatus on a geminated tooth: a case report. *J Contemp Dent Pract* 2007;8:99–05.

Copyright 2015 BMJ Publishing Group. All rights reserved. For permission to reuse any of this content visit <http://group.bmj.com/group/rights-licensing/permissions>.
BMJ Case Report Fellows may re-use this article for personal use and teaching without any further permission.

Become a Fellow of BMJ Case Reports today and you can:

- Submit as many cases as you like
- Enjoy fast sympathetic peer review and rapid publication of accepted articles
- Access all the published articles
- Re-use any of the published material for personal use and teaching without further permission

For information on Institutional Fellowships contact consortiasales@bmjgroup.com

Visit casereports.bmj.com for more articles like this and to become a Fellow