Collaborative endodontic and surgical management of a type II dens invaginatus: One year follow-up

Kammishetty Shekar, Dola Binoy, Bollavaram Vijaya Ramakrishna Reddy, Cherukupalli Ravi Chandra, Surrender Reddy, Bolli Indhira Priyadharshini

ABSTRACT
This case report illustrates type II dens invaginatus (DI) and analyzes the possible aspects of this defect. Dens invaginatus is a developmental anomaly of teeth that commonly affects permanent maxillary lateral incisors. This case report focuses on the non-surgical and surgical management of right maxillary lateral incisor associated with type II DI. Pulpal involvement of malformed tooth, bizarre in root canal anatomy, periapical pathosis and severe periodontal destruction were noticed. Endodontic therapy with combined obturation techniques, surgical therapy with apical-curettage, retrofilling with glass ionomer cement and bone grafting were performed. A year follow-up evaluation showed satisfactory periapical healing.
Collaborative endodontic and surgical management of a type II dens invaginatus: One year follow-up

Kammishetty Shekar, Dola Binoy, Bollavaram Vijaya Ramakrishna Reddy, Cherukupalli Ravi Chandra, Surrender Reddy, Bollu Indhira Priyadharshini

ABSTRACT

This case report illustrates type II dens invaginatus (DI) and analyzes the possible aspects of this defect. Dens invaginatus is a developmental anomaly of teeth that commonly affects permanent maxillary lateral incisors. This case report focuses on the non-surgical and surgical management of right maxillary lateral incisor associated with type II DI. Pulpal involvement of malformed tooth, bizarre in root canal anatomy, periapical pathosis and severe periodontal destruction were noticed. Endodontic therapy with combined obturation techniques, surgical therapy with apical-curettage, retrofilling with glass ionomer cement and bone grafting were performed. A year follow-up evaluation showed satisfactory periapical healing.

Keywords: Demineralized freeze-dried bone allograft (DFDBA), Dens invaginatus (DI), Dental anomalies, Endodontic therapy and endodontic surgery, Guided tissue regeneration (GTR)

INTRODUCTION

Dens invaginatus (DI) is a developmental anomaly of the tooth resulting from invagination of the enamel organ into the dental papilla during development phase of tooth and before calcification phase. Coronal invagination usually originates from an anomalous infolding of the enamel organ into the dental papilla. The most severe form of this anomaly is referred to as ‘dilated odontoma’ [1]. Dens invaginatus was first described by Ploquetin in 1794 who found it in whale’s tooth and in 1856, Socrates described the DI anomaly in human beings. Synonyms for dens invaginatus are dens in dente, dilated gestant...
odontoma, invaginated odontome, dilated composite odontome, dentoid in dente, and tooth inclusion [2].

Oehlers described DI coronalis and DI radicularis. Oehlers proposed coronal invaginations in 1957. He described the anomaly in three forms:

Type I: An enamel-lined minor invagination confined within the crown not extending beyond the cemento-enamel junction (Figure 1a).

Type II: An enamel lined invagination invading the root but remains confined as a blind sac. It may or may not communicate with the dental pulp (Figure 1b).

Type III A: invagination extending into the root and communicating laterally with the periodontal ligament space through a pseudoforamen. There is usually no communication with the pulp, which lies compressed within the root (Figure 1C). Type III B A-invagination which extend through the root and perforates apically through a pseudoforamen (Figure 1D) [3].

In 1972, Schulze and Brand proposed a more detailed classification, including coronal invaginations and dysmorphic root configuration. Kronfeld speculated that DI is caused by failure in growth of the internal enamel epithelium and increased proliferation of surrounding epithelium producing a static area of engulfing. Ectomesenchymal signaling between dental papilla and internal enamel epithelium can affect tooth morphogenesis. They have specific roles such as tooth morphogenesis and infolding of enamel organ [3]. The incidence of DI is about 0.04–10% and maxillary lateral incisors are most frequently affected approximately 9% and bilateral involvement of 43% [4, 5]. According to the theories put forward by Hulsmann the etiology behind DI is distortion of the internal enamel epithelium development, infections and traumas.

Dens invaginatus can be asymptomatic or symptomatic with evident signs including malformation and mottling of the crown, tumefaction of the soft tissue, cyst, tooth eruption defect, and communication with the maxillary sinus with indications of sinusitis.

A radiographic examination reveals a radiopaque invagination, equal in density to the enamel that extends for varying distances from the cingulum to inside the roots.

Treatment of DI depends upon the degree of complexity of root canal system. Treatment modalities include non-surgical endodontic treatment, surgical endodontic treatment, intentional replantation or extraction [2].

CASE REPORT

A 25-year-old male patient was referred to the clinic for regular dental check-up. The patient’s general health and the systemic review were unremarkable. On oral examination, the maxillary right incisor, 12 revealed a light brownish discoloration, without caries, mobility and tenderness on percussion. Periodontal evaluation revealed deep periodontal pocket at the mesial surface of the tooth. Upon vitality tests tooth 12 was non-responsive to cold, heat and electric pulp tests whereas adjacent teeth 13, 11, 21 revealed normal response. The panoramic and periapical radiographs revealed radiopaque mass in the 12 (Figure 2). Cone beam computed tomographic (CBCT) evaluation revealed a large pulp space volume extending...
from coronal third to middle third of the root and a small enclosed pulp canal space in middle third of root which cannot be accessed (Figure 3).

Based on clinical and radiographic examination the final diagnosis made was dens invaginatus with pulpal necrosis and periapical abscess i.r.t 12. Hence endodontic treatment was advised followed by surgical therapy at subsequent appointments with 12.

**Endodontic Treatment**

After administration of local anesthesia (lignocaine, 1:80,000 adrenaline), tooth 12 was simultaneously isolated with rubber dam. While preparing access cavity, we could not locate the canal there was a difficulty in negotiating the pulpal space. Root canal debridement is difficult in dens invaginatus cases because of unpredictable canal anatomy and narrow access and the establishment of ideal smooth wall configuration of the root canal was not possible as the invaginated tooth structure was obstructive. Central hard tissue was removed using gates glidden drills. Initial investigation of root canal system in 12 was performed with 10 k-file (Dentsply, Maillefer). Working length was determined. An apex locator (Root ZX II) was used to verify the working length. Initial canal flaring was done with Gates Glidden drill #3 and Protaper rotary Ni-Ti SX file (Protaper universal, DENTSPLY, Maillefer). Canal was enlarged till 110 k-file size (k-files, sybronendo). During instrumentation, 100 ml of normal saline, 50 ml of 5.25% sodium hypochlorite (Prime dental products, India) and 2% chlorhexidine (Prime dental products, India) was used separately with saline as an intermittent irrigant. Calcium hydroxide dressing was given as inter-appointment canal dressing. Before obturation, laser irradiation was done using diode laser (SIRONA laser Xtend, 810 nm). Obturation was performed using cold lateral and vertical compaction techniques with standardized gutta percha cones and AH-26 sealer till middle third of root canal.

Obturation in inaccessible canal area underneath the invagination and in rest of the root canal was done using Calamus dual thermoplasticized gutta-percha (Figure 4). Temporization was done.

**Surgical management**

Seven days after the endodontic treatment, patient presented in office without any clinical symptoms. A full thickness mucoperiosteal flap was raised under infra orbital block anesthesia in right maxillary region and nasopalatine nerve block anesthesia in palatal region. A large bony lesion was revealed involving the root and apices of right maxillary lateral incisor. Monocortical (labial) involvement of bone was evident which warranted for the use of bone graft and guided tissue regeneration. Thorough curettage of the bony crypt was done and complete removal of the pathology was ensured, following which, apical resection of 3 mm was done in relation to 12. Diode laser (SIRONA laser Xtend, 810 nm, 1.2 W, continuous focus mode) was used for sterilization of resected apical root dentin surface and sanitization of surgical site. Later, the bony defect was condensed with demineralized freeze dried bone allograft (DFDBA) milled with blood (Figure 5). Once the defect was packed, resorbable biocollagen GTR (guided tissue regeneration) membrane was placed around the bony defect on the surrounding healthy bone, the

![Figure 3: Cone beam computed tomography showing variations in the root canal space and amount of bone loss.](image1)

![Figure 4: Intraoral periapical radiograph showing obturation of the complete canal space in 12.](image2)
mucoperiosteal flap was sutured completely without exposing the GTR membrane. The patient was recalled after seven days for suture removal. Postoperative soft tissue healing was uneventful and symptom free. The clinical appearance of the surgical area was satisfactory. Patient was recalled in period of interval on 3rd, 6th and 12th month postoperatively for clinical and radiographic evaluation. Upon periodontal evaluation probing depth was not evident indicating a positive sign of satisfactory periodontal healing (Figure 6).

DISCUSSION

Getting across with DI was a rare event for past few years. However, with increased number of dental screenings it is no longer a rare event today. Dens invaginatus is a hard tissue anomaly which is routinely unaffected and asymptomatic unless infected. It requires early diagnosis and treatment, as it may result in radicular and periapical pathosis. Dental invaginations on long standing may lead to of pulpal and periapical pathosis, which is from pulpal death [6, 7]. The treatment of invaginated teeth is a complex procedure. They present a complex root canal configuration that is often not possible to instrument completely. As a result, these teeth should be selected for combined orthograde and surgical treatment [8].

Usually, a patient will not discover an anomaly such as dens invaginatus until clinical signs appear, i.e., an acute dentoalveolar abscess or sinus tract. The first observation brought to light was light brown discoloration of the tooth 12. The panoramic and intraoral periapical radiographs showed large periapical radiolucency around 12. Cone beam computed tomography scan was very helpful in confirming the observations and giving more detailed anatomical variations and thus rendering more accurate and immediate treatment plan. With intraoral periapical radiography, external factors such as anatomical noise, geometry, poor irradiation, may reduce the detection level of periapical lesions. Cone beam computed tomography, apart from removing these external factors, improves the view of area of interest [9]. On the coronal axis scans tooth showed obstruction of the main canal with invaginated mass with a narrow access to the radicular canal. On the mid root axis scan, small separated canal was visualized. The treatment plan decided was root canal sanitization, 3-D obturation of root canal system and periapical surgery [10]. Combined obturation techniques were used which include cold lateral condensation and back fill with thermoplasticized gutta percha using Calamus system.

In endodontic surgery, conventional periapical curettage with apical root resection was performed. To improve the rate of healing diode laser (810 nm) was used for sanitization of bony crypt and resected apical root dentin [11]. Diode laser is bactericidal, stimulates cell proliferation and shows inhibitory effect on inflammatory propagating enzymes. Repeated 2–3 laser irradiations results in ‘knock on’ effect on bacteria. Demineralized freeze dried bone allograft was used to pack the large bony lesions. It is osteoconductive as DFDBA causes bone to from heterotopically [12].

Bony defect was sealed with GTR membrane. In many case reports authors have concluded that the quality and quantity of regenerated bone formed was superior in case of GTR membrane [13, 14]. One year postoperative CBCT was taken to confirm the radiographic success of the endodontic and surgical therapy. This case report discusses not only the treatment but also rationale behind the treatment modalities.

CONCLUSION

One year follow-up of this dens invaginatus case showed clinical and radiographic success after orthograde and retrograde endodontic treatment.
article, Final approval of the version to be published
Binoy Dola – Substantial contribution of conception and design, Acquisition of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published
Bollavaram Vijaya Ramakrishna Reddy – Substantial contribution of conception and design, Acquisition of data, Drafting the article, Final approval of the version to be published
C. Ravi Chandra – Substantial contribution of conception and design, Acquisition of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published
Munnangi Surrender Reddy – Substantial contribution of conception and design, Acquisition of data, Drafting the article, Final approval of the version to be published
B. Indhira Priyadharshini – Substantial contribution of conception and design, Acquisition of data, Drafting the article, Revising it critically for important intellectual content; Final approval of the version to be published

Guarantor
The corresponding author is the guarantor of submission.

Conflict of Interest
Authors declare no conflict of interest.

Copyright
© 2016 Shekar Kammishetty et al. This article is distributed under the terms of Creative Commons Attribution License which permits unrestricted use, distribution and reproduction in any medium provided the original author(s) and original publisher are properly credited. Please see the copyright policy on the journal website for more information.

REFERENCES
ABOUT THE AUTHORS


Shekar Kammishetty is Head of the Department at Conservative Dentistry and Endodontics. He has published 14 research papers. His research interests include regenerative endodontics. He intends to pursue PhD in future.
E-mail: drshekarmds@gmail.com

Binoy Dola is Assistant Professor at Conservative Dentistry and Endodontics. He has published 8 research papers. His research interests include Advanced Rotary Endodontics and laser dentistry. He intends to pursue residency in laser dentistry in future.
E-mail: binoy.dr.binoy@gmail.com

Bollavaram Vijaya Ramakrishna Reddy MDS, Bollavaram Vijaya Ramakrishna Reddy, Assistant Professor, Conservative Dentistry and Endodontics, Sri Sai Dental College of Surgery, Telangana, India.

Cherukupalli Ravi Chandra MDS, C. Ravi Chandra, Reader, Conservative Dentistry and Endodontics, Sri Sai Dental College of Surgery, Telangana, India.

Surrender Reddy MDS, Munnangi Surrender Reddy, Reader, Pediatric Dentistry, Sri Venkata Sai Dental College, Telangana, India.

Bollu Indhira Priyadharshini MDS, B. Indhira Priyadharshini, Assistant Professor, Conservative Dentistry and Endodontics, St. Joseph Dental College, Andhra Pradesh, India.
Edorium Journals: An introduction

Edorium Journals Team

About Edorium Journals
Edorium Journals is a publisher of high-quality, open access, international scholarly journals covering subjects in basic sciences and clinical specialties and subspecialties.

Invitation for article submission
We sincerely invite you to submit your valuable research for publication to Edorium Journals.

But why should you publish with Edorium Journals?
In less than 10 words - we give you what no one does.

Vision of being the best
We have the vision of making our journals the best and the most authoritative journals in their respective specialties. We are working towards this goal every day of every week of every month of every year.

Exceptional services
We care for you, your work and your time. Our efficient, personalized and courteous services are a testimony to this.

Editorial Review
All manuscripts submitted to Edorium Journals undergo pre-processing review, first editorial review, peer review, second editorial review and finally third editorial review.

Peer Review
All manuscripts submitted to Edorium Journals undergo anonymous, double-blind, external peer review.

Early View version
Early View version of your manuscript will be published in the journal within 72 hours of final acceptance.

Manuscript status
From submission to publication of your article you will get regular updates (minimum six times) about status of your manuscripts directly in your email.

Our Commitment

Six weeks
You will get first decision on your manuscript within six weeks (42 days) of submission. If we fail to honor this by even one day, we will publish your manuscript free of charge.*

Four weeks
After we receive page proofs, your manuscript will be published in the journal within four weeks (31 days). If we fail to honor this by even one day, we will publish your manuscript free of charge and refund you the full article publication charges you paid for your manuscript.*

Favored Author program
One email is all it takes to become our favored author. You will not only get fee waivers but also get information and insights about scholarly publishing.

Institutional Membership program
Join our Institutional Memberships program and help scholars from your institute make their research accessible to all and save thousands of dollars in fees make their research accessible to all.

Our presence
We have some of the best designed publication formats. Our websites are very user friendly and enable you to do your work very easily with no hassle.

Something more...
We request you to have a look at our website to know more about us and our services.

* Terms and condition apply. Please see Edorium Journals website for more information.

We welcome you to interact with us, share with us, join us and of course publish with us.

CONNECT WITH US

Weed Journals: On Web
Browse Journals

This page is not a part of the published article. This page is an introduction to Edorium Journals and the publication services.