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Case Report

Multidisciplinary Management of Dens Invaginatus Type IIIa Associated with A Latero-Radicular Lesion: A Case Report

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ABSTRACT

Dens Invaginatus (DI) is a developmental anomaly that implies the invagination of the enamel organ into the dental prior to calcification of the dental tissues. There is a lack of consensus regarding the etiology of this malformation. DI Type III implies an extension of the invagination into the root generating a second lateral or apical foramen and is the most complex form. Managing these teeth represents a challenge for dentists. The aim of this paper is to represent the multidisciplinary management of central maxillary incisor presenting with dens invaginatus Type IIIa associated with a latero-radicular lesion and to highlight the importance of Cone-beam computed tomography scan (CBCT) in posing accurate diagnosis and planning adequate treatment. The second aim is to acknowledge the role of new technologies and advances in enhancing the prognosis of such teeth.

Keywords: Dens invaginatus; Periradicular lesion; Cone-beam computed tomography; Surgical treatment

INTRODUCTION

Densinvaginatus (DI), called more commonly « dens in dente », is a developmental anomaly. It implies the invagination of the enamel organ into the dental papilla forming an enamel-lined cavity that intrudes into the crown

or root. This phenomena occurs prior to calcification of the dental tissues.[1] Its incidence varies between 0.4% and 10% in the general population.

It affects mostly permanent lateral incisors, followed by central incisors, premolars, canines, and molars.[2] There is a lack of consensus regarding the etiology of this malformation. Several theories have been proposed to understand the DI condition including environmental, infectious, traumatic and genetic factors. But the main cause is still not fully understood.[3]

Multiple classifications have been proposed to describe this malformation. The most popular one was proposed by Oelhers in 1957.[4] It outlined the condition in three categories according to the extent of the invagination into the root. DI Type 3 implies an extension of the invagination into the root generating a second lateral or apical foramen. There is no communication with the dental pulp. It might be lined by enamel or even cementum.[5] Diagnosis and management of these teeth with complex root canal system are improved with the use of three-dimensional imaging techniques as well as advanced treatment options.

The present case report aims to document the multidisciplinary management of a central incisor presenting with dens invaginatus Type IIIa associated with a latero-radicular lesion.

CASE PRESENTATION

A 20-year old female patient presented to our department to treat her maxillary left central incisor. Her clinical data are presented in the Table 1.

Table 1: Clinical data of the patient:

Chief complaint	
Constant mild pain and tenderness to bitting in relation with the maxillary left central incisor + History of pus discharge in relation with the same tooth	
Medical History	
Non contributory	
Dental History	
Endodontic treatment of maxillary left central incisor	
Failure to attend follow-up appointments	
Extra-oral Examinassion	
No abnormality	
Intra-oral Examination	
Inspection	- Atypical morphology : Big crown compared to the right incisor associated with a colour alteration (Figure 1)
	- Provisional restoration
	- Scar of sinus Tract over the palatal alveolar mucosa (Figure 2)
	- Agenesis of both lateral maxillary incisors

Percussion	Tender to vertical percussion
Mobility	Normal
Periodontal probing	2 mm all around the tooth
Radiographic examination	
Intra-oral peri-apical radiograph	- Oehlers' type 3 invagination with a latero-radicular radiolucent lesion on the mesial aspect of the tooth root, extending to the apex. (Figure 3)
	- The main canal was partially filled with gutta percha in the apical third
CBCT	- Coronal slices confirmed the diagnosis of DI Type 3a Oelhers with a lateral psuedo-foramen. The latero-radicular lesion was surrounded with a well-circumscribed sclerotic border and its size was approximately over 200 mm2. (Figure 4) - Coronal-axial slices showed the perforation of both palatal and buccal cortical plate as well as a semi-solid density of the lesion (Figure 5)

Diagnosis of Oehler's type 3a DI with chronic apical periodontitis was made at the left maxillary central incisor. The treatment plan was to perform endodontic retreatment of the tooth and then to enucleate the cystic lesion surgically.

First Appointment:

Following rubber dam setting, restoration was removed with a round bur. Internal anatomy was visualized under magnification of dental operating microscope (Figure 6). Gutta percha and sealer were removed from the main canal using rotary files and ultrasonic tips. Access to the invagination was enlarged with ultrasonic tips to perform proper lumen disinfection and space filling. A 10 K file was used to confirm patency. The working length was established using an electronic apex locator iPex (NSK, Tochigi, Japon)and confirmed with a periapical radiograph (Figure 7). The space of invagination as well as the main canal was generously irrigated with 3% NaOCl and 17% Ethylenediaminetetraacetic acid (EDTA), alongside with ultrasonic activation. Calcium hydroxide paste (Multi-Cal, Pulpdent Corporation, USA) was inserted for 2 weeks, and the cavity was sealed with a temporary restoration.

Second Appointment:

At the two-week follow-up appointment, the tooth was Asymptomatic. The access cavity was reopened under rubber dam isolation and the canal root was copiously irrigated using saline to remove calcium hydroxide pasten. In the final irrigation sequence, 17% EDTA solution was applied with ultrasonic activation. Then, neutralization with normal saline solution, and final irrigation with sodium hypochlorite 3 % activated with the same ultrasonic technique were performed. Finally, the canal space was dried with a paper point. The cervical part of the invagination and the apical part of the main canal were sealed with mineral trioxide aggregate (MTA, Dentsply, Tulsa, OK, USA) and condensed with hand pluggers (Figure 8). After allowing one day for setting of MTA, the remaining space of main canal was filled with thermoplastic gutta-percha (Figure 9).

Figure 1: Unusual shape of 21 + colour.

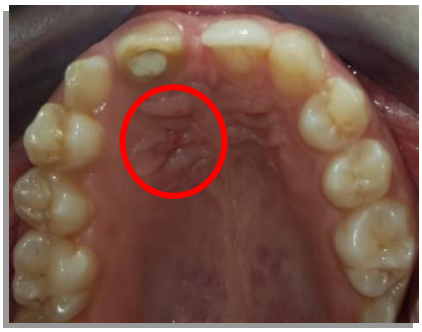

Figure 2: Scar of a sinus tract in relation with 21.

Figure 3: Preoperative radiograph of 21.

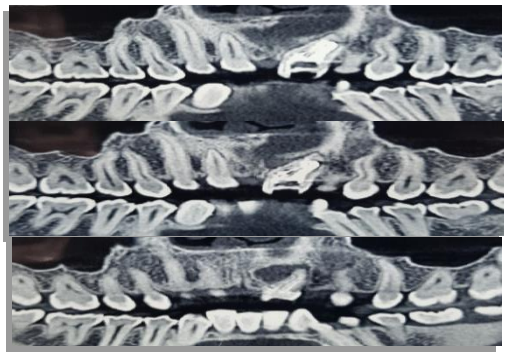

Figure 4: CBCT Scan : Coronal slices.

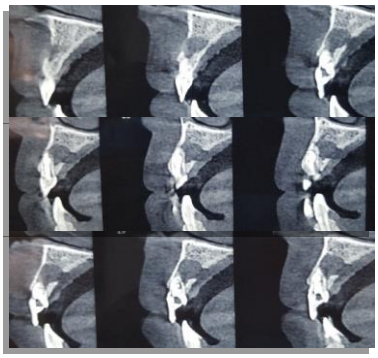

Figure 5: CBCT Scan : Coronal-axial slices.

Figure 6: Internal anatomy of the invaginaton and main canal under magnification.

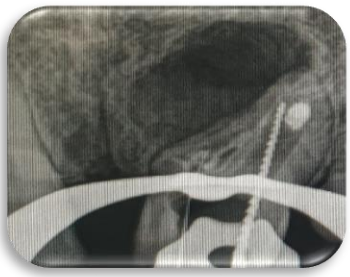

Figure 7: Peri-apical radiograph confirming working lengths.

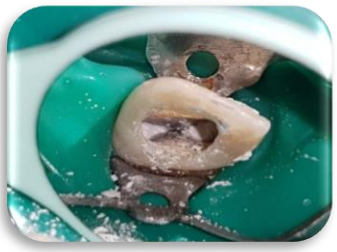

Figure 8: Plug of MTA placed in the invagination and apical part of the main canal

Figure 9: Periapical radiograph showing final obturation of 21.

Third Appointment:

Surgical procedure was performed under dental operating microscope. Treatment was initiated using 2% lidocaine with 1:80000 epinephrine. A full-thickness mucoperiostal was reflected using intrasulcular incision and vertical release.The lesion had perforated the cortical bone (Figure 10).Thin cortical buccal bone was removed to create the bony window using a round bur in a slow speed hand piece with physiological saline irrigation. The cystic tissue was carefully enucleated then sent to oral pathology laboratory. Several lateral pseudo-foramina were visualized under magnification upon osteotomy (Figure 8).The root end resection (3mm) was performed with high-speed fissure bur. Cavities preparation of pseudo-foramina were done using ultar-sonic retrograde tips. Retrograde filling was performed with MTA plug (Figure 11 & 12). Then the flap was repositioned and sutured. The histological evaluation of the biopsy confirmed the diagnosis of a radicular cyst.

Figure 10 : Perforation of buccal cortical plate. foramina in relation with the invagination .

Figure 11: Root-end resection and visualisation of multiple

Figure 12: Periapical radiograph : retrograde obturation of the invagination.

Follow up Appointment:

The patient was seen after one month for the follow-up. Clinical examination demonstrated satisfactory healing and normal function of the tooth (Figure 13). The patient hasn't complained about pain or infection signs.

Figure 13: Clinical examination after 1 month.

DISCUSSION

Management of teeth with type III invagination associated with a latero-radicular lesion represents a challenge for dentists. It is in relation with the internal complex morphology that makes the disinfection and the filling difficult. Based on the type and complexity of the invagination, multiple management choices have been described such as

preventive treatment, restorative procedure, non-surgical endodontic treatment of only the invagination or both invagination and main canal, surgical treatment, intentional replantation or even extraction.[6]

Clinical Assessment:

Complex DI lesions may be associated with unusual crown morphology while simple forms asymptomatic with minimal external deformities.[7]Other dental anomalies may be present concomitantly such as hypodontia, hyperdontia or macrodontia.[8] Some of these abnormalities were present in this case report such as dilated crown of the concerned tooth as well as hypdontia (Agenesis of both lateral maxillary incisors).

It has been demonstrated that many teeth with DI type III are associated with pulpal diseases or periapical lesion. The key in managing dens invaginatus type III is the precise assessment of the vitality of the main canal and preserve it if present.[9] In the present case, the main canal was already treated. The aim of our treatment was to retreat the main canal, debride the invagination and fill them densly. Afterwards the cyctic lesion should be managed surgically.

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Radiographic Assessment:

Periapical radiograph is commonly used in endodontic diagnosis and treatment. To assess the type and the morphology of the invagination it is important to take a radiograph with a 15° change in the horizontal angulation of the beam and to place the tube more mesially.[10] Unfortunatly this 2-dimensional radiograph does not offer precise assessment of the altered mophology of the invagination as well as the characteristics of the cystic lesion. This is why CBCT has become a useful tool of diagnosis since it provides a three dimensional reconstruction and evaluation of the affected tooth and surrounding tissues.[8] In our case the CBCT scan showed us the complex anatomy of the invagination with formation of wave-like constrictions and dilatations and presence of enamel within these constrictions. It served as well to determine a preo-perative diagnosis of periapical cyst based on several specific radiologic criteria. These criteria could differentiate moderately a cyst from granuloma.[11] They are presented in the table n°2. As regards to the volume of the lesion, it has been demonstrated that if the volume exceeds 247 mm^3 there was 80% probability of a cyst. In our case, the volume of the lesion was over 247 mm^3.[12] All the criteria mentioned above led us to pose a preoperative diagnosis of radicular cyst and surgical treatment was performed. Afterwards, histological evaluation confirmed the nature of the cystic lesion.

Table II: Diagnosis criteria based on CBCT

Diagnosis criteria based on CBCT	**The presented case**
Location of the lesion	Lateral aspect of the root+ extension to the apex
Periphery	Well defined corticated border
Shape	Circular
Internal structure	Radiolucent
Effect on surrounding structures	No Effect
Effect on surrounding bone	Perforation of buccal and palatal cortical plate

THERAPEUTIC MANAGEMENT

Non Surgical Retreatment:

Thanks to the advent of new technologies in dentistry, treatment has become more predictable. The use of dental microscope magnification and ultrasonic instrumentation has given new possibilities to the dentists. Actually in the present case, the microscope helped us in defining the access to the invagination and eliminating the totality of the gutta percha and sealer from the main canal.

The DI space was minimally instrumentated with hand K files. In fact, it is unadvisable to use rotary instrumentation since the invagination has an inconsistent and unpredictable shape. Moreover endodontic instruments are designed to remove dentine not enamel.[13] The surface might be covered with enamel particles that leads to instrument separation which increases the difficulty of the treatment.[14] Whereas K files, H-files or low speed gates glidden drills may be manually controlled by the dentist's feeling while preparing the canal.[8,15]

Importance of Chemical Disinfection:

With the presence of a persistent latero-radicular lesion, a special attention should be payed to the chemical disinfection. In the reported case, the irrigation was performed with copious amount of 3% NaOCl. It represents the gold standard of irrigants due to its antibacterial, sporicidal and virucidal activity.[16] Some authors recommend the use of chlorhexidine 2% at the end of the chemo mechanical preparation to maximize the antibacterial effect thanx to its substantively.[17] In the final rinse, EDTA 17% was used in combination with the NaOCl 3%It has been demonstrated that alongside with its effect on removing the smear layer, it plays a role in detaching biofilm from the canal and reducing bacterial endotoxins lipopolysaccharides.[18] Activation of the irrigation using ultrasonic tips improves the chemical disinfection. In fact it allows their delivery to uninstrumented areas of the invagination as well as apical and lateral isthmus.[19] Calcium hydroxide was placed in the canal for 14 days as an inter-appointment medication. It has been chosen for its antibacterial action, dissolution of organic tissue capacity and hard tissue formation stimulation.[20]

Final Obturation :

Concerning the final obturation, the complex anatomy of the invagination as well as the large size of the main canal did not allow conventional filling with gutta percha. That's why MTA was used to seal the coronal and accessible part of the invagination and placed as an apical plug in the main canal. It has been demonstrated that this material is biocompatible, promotes hard tissue regeneration and improves the resistance to vertical root fracture.[9] However it presents the drawback of possibly causing tooth discoloration which hasn't occurred yet in the present case.

Surgical Treatment:

Endodontic surgery was performed under magnification of dental microscope to allow a precise and conservative procedure. In the invagination space, several foramina were visualized confirming the unexpected and complex anatomy of this entity. Root end resection was done perpendicular to the long axis of the root. Some authors demonstrated that creating a steep bevel on the resected root end is unnecessary and may lead to damage the supporting bone or incomplete root resection.[21] As for the root-end preparation, the ultrasonic tips should be used parallel to the long axis of the root with a light and sweeping motion. Continuous pressure with ultrasonic tips is not recommended since it decreases the cutting efficiency. Root-end filling is the last part of the surgical treatment. The apical seal was performed with MTA.

This procedure requires a good hemostasis in the bone crypt and dryness in the root'en cavity. That's why some authors recommend the placement of epinephrine-impregnated cotton pellet at the depth of osteotomy. Alongside with hemostasis, these cotton pellet prevent the filling materiel from falling at the bottom of the alveolar bone.

CONCLUSION

DI is a rare developmental malformation but with large range of variations. Managing this type of teeth aims to eradicate infection, preserve tooth structure and restore aesthetics and function. Diagnosis should be based on meticulous clinical and radiographic evaluation. Allying use of CBCT for diagnosis and dental microscope and biomateriels for treatment may yield better outcomes.

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