Non-Surgical Management of a Superior Central INCISOR with Incomplete Apexogenesis and Dens Invaginates Type II; Employing Biodentine

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Abstract

Dens invaginatus (DI) is a development anomaly, which exhibits a wide spectrum of morphological variations, resulting from the invagination of the enamel organ in the dental papilla during the stage of development of oral tissues.

This article reports the case of a seven-year-old child with pain on palpation and pressure in relation to the upper right central (tooth 1.1), purulent collection and increased volume in adjacent tissues in relation to the oral face of said tooth.

After the clinical and radiographic diagnosis it was concluded that we were in the presence of an acute apical abscess (submucosal abscess) in a young permanent tooth (with incomplete Apexogénesis) with presence of type II ID.

To address this case, a root canal treatment and an apical closure were performed with the use of a bioceramic; Biodentine (Septodont, Saint-Maur-des-Fosses, France) to subsequently rehabilitate it with fiberglass pole and nanoparticulate light-curing resin.

Keywords: Apexogenesis; Dens Invaginates; Biodentine

Introduction

Dens Invaginatus (DI), also known as Dens in Dente was first found by Plaque in 1794 in the tooth of a whale and later reported in a human tooth by the dentist Socrates in 1856. It is a developmental anomaly, which exhibits a wide spectrum of morphological variations, resulting from the invagination of the enamel organ in the dental papilla during the stage of development of oral tissues. As hard tissues are formed, the invaginated enamel organ leads to the formation of a small tooth in the future chamber pulp chamber [1,2]. The affected teeth show a structural defect radiographically ranging from a slight folding of the enamel and dentin, to an invagination that can extend deep into the pulp chamber, the root and sometimes reach the root apex, and may exhibit a great variations in size and shape. Although the etiology of ID is not clear, this anomaly can affect any tooth, although it has a great predilection for maxillary lateral incisors [2].

Its prevalence ranges between 0.3% and 10%, it is found most frequently in the upper lateral incisors, followed by the upper central incisors, while it is rare in the canines, premolars and molars. This anomaly can occur concomitantly with other dental anomalies such as hypodontia, hyperdontia or macroence [3].

The most used DI classification was the one proposed by Oehler’s in 1957, he described the anomaly in three subtypes, which are based on the extension of the apical migration of enamel invagination and other dental structures. In type I, intussusception is minimal and enamel coated, confined within the crown of the tooth and does not extend beyond the cement-enamel junction level. In type II, an
invagination coated with enamel that invades the root but remains confined to it like a blind sac. It may or may not communicate with the dental pulp and may or may not be very dilated. In type III the invagination penetrates through the root perforating apically or laterally in the area showing a “second foramen” in the apical or in the periodontal space giving rise to Type III subtype B, Scheme I. Generally there is no communication with the pulp, which is compressed inside the wall around the process of intussusception [4].

To make the diagnosis of a DI, conventional periapical radiographs (2D two-dimensional images) are used, but thanks to the development and application of the computed tomography technology (3-D three-dimensional image); in endodontics, the analysis of the anatomy of the root canals is more effective when compared with other techniques [1,5].

The treatment options for DI are varied from preventive sealing, treatment of invaginated tooth or continent tooth depending on the tooth that originates the pathology, surgical treatment, intentional reimplantation or extraction. If the intussusception is minimal and limited to the crown, a preventive seal of the structural defect is made when the pulp has not been affected. If pulpal disease exists, depending on the age of the patient and the status of the apical foramen (open or closed), the treatment could vary from root canal treatment in mature teeth to apexification or pulp revascularization techniques in young or immature permanent teeth [4,6-8].

Apexification is a procedure frequently used for DI cases with immature apices, with techniques such as the application of calcium hydroxide to induce the formation of an apical calcified barrier with tissue of the osteoid, cementoid or similar type. Among its disadvantages is the need for multiple visits, for a relatively long time (an average of 12 months) and the fact that usually the root walls do not increase their parietal growth and with prolonged application, the dentine becomes fragile [9].

Another alternative is the use of mineral trioxide aggregate (MTA ProRoot MTA, Dentsply, Tusa, OK USA) or Biodentine (Septodont, Saint-Maur-des-Fosses, France). To produce an artificial apical barrier that prevents extrusion of the filling material during the filling [10-12].

The MTA is a bioactive material that has been used for various applications in endodontics. It is indicated among other uses, for pulp therapy in permanent and deciduous teeth, apical sealing of the root canal in teeth with mature and immature apices. It has been shown that MTA is biocompatible, stimulates mineralization and promotes crystal deposits similar to apatite [10].

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Taking as a reference the properties of the bioceramic MTA, is that Biodentine was developed, a bioceramic of last generation, material based on Calcium silicate, which can be a valid option since it acts as a substitute for dentine, with antibacterial action, of which no cytotoxicity, genotoxicity or mutagenicity has been reported. When compared to the MTA, it presents better physical and biological properties, better handling, fast setting time, greater resistance to compression, early synthesis of reparative dentin, other qualities [11].

This last technique is convenient, since the Biodentine sets faster than the MTA allowing these cases to be finalized in 2 appointments. However, it could present the same disadvantage as a tooth treated with calcium hydroxide in terms of the parietal growth of its walls. The Biodentine forms a strong bond with the dentine, ideally it is recommended that while placing the plug in the apical third, go depositing part of the Biodentine on the internal walls of the canal and thus strengthen them [12].

Recently, cases of DI in young permanent teeth have been reported, which have been successfully treated with pulp revascularization. Revascularization is a new method of treatment for necrotic immature permanent teeth, providing the possibility that after treatment, the tooth completes its apexogenesis. Pulp revascularization occurs at the expense of the ability of the residual pulp, apical and periodontal stem cells to differentiate and generate a highly vascularized and conjunctive living tissue [13-15].

The ideal treatment to obtain the best root development and thickening of the dentinal walls would be the revascularization of the dentin-pulp complex. This technique is indicated in cases of avulsed teeth, with dislocations, traumatized, teeth with developmental anomalies (gemination, concrescence, dens invaginatus, among others); teeth with incomplete apexogenesis and communication of pulp and peri-radicular tissue and cases of partially necrotic and infected pulp [16-19].

In 2010 they reported three cases of type I DI in young permanent teeth with open apex that were treated successfully by different methods, including calcium hydroxide apexification and periapical surgery. Therefore, treatment options must be carefully chosen according to individual characteristics [20].

In the present case we describe the management of Dents Invaginatus in the upper right central incisor, by using Biodentine to produce an artificial apical barrier and the subsequent rehabilitation of custom fiberglass poles and light-cured hybrid nano-resin.

Clinical Case Report

Male patient, 7 years of age, ASA I. Clinical examination of tooth 1.1 shows a Dens Invaginatus (DI), with pain on palpation and pressure. Clinical examination shows an acute apical abscess (submucosal abscess), purulent collection and increased volume in adjacent tissues in relation to the buccal surface of said tooth. The palatal tooth shows a projection of the dens invaginatus, which presents extensive caries lesion in its interior and whose cusp was eroded by the action of the occlusion with its antagonist (Figure 1b). When performing sensitivity tests, they are negative to heat and cold while palpation and percussion are positive.

Radiographically, an open apex, thin walls, is observed, a developmental anomaly compatible with an invaginatus type II dens (Figure 1c). A computerized tomography is requested to evaluate the internal anatomy of the tooth three times, the extension of the lesion and plan the treatment of the case, evaluating the therapeutic options.

The tomography reported the following findings: open apex (incomplete apexogenesis), presence of dens invaginatus type II, sketch of a partially calcified pseudo canal in dense indent, thin radicular walls (Figure 1d).
In relation to tooth 1.1, it was concluded in the following diagnosis: Acute apical abscess in young permanent tooth (with incomplete Apexogénesis) with the presence of type II ID.

An initial Treatment plan was proposed, whose objectives were in the first place; control the infection and promote the revascularization of the dental organ to later perform a rehabilitation. The treatment plan was divided into the following stages: 1) Mechanical chemical preparation of the root canals; 2) Revascularization technique with the use of PRF; 3) Coronal sealing with Biodentine and 4) Definitive rehabilitation.

Previous absolute isolation (Figure 2a) attempts to make two different accesses; one at the expense of the caries cavity of the Dens Invaginatus (Figure 1b) and the other accessing the main channel, finally joining in the apical third. Unfortunately, the ID channel was not permeable for its subsequent preparation and cleaning, so the treatment had to be reconsidered, starting with access, since the possibility of not adequately removing the pathogens from the canal confronts us with a frank failure. At that time, due to the extensive caries present, the lack of permeability of its channel and the multiple communications between the main channel and the DI channel, the access was redesigned and it was decided to eliminate the DI from the access of the main channel, creating This way a single and large channel (Figure 2b).

Thanks to this strategy the walls were kept intact, to irrigate with abundant sodium hypochlorite at 5.25%, using the technique of irrigation with negative pressure, to minimize the risk of driving the irrigator towards the periapices and thus obtain a good bacterial control apical level.
Due to the possibility of not obtaining an adequate cleaning of this abnormally wide channel, it is decided to use several sessions of intracanal medication to obtain that objective. If we stop and evaluate the steps we were taking, we realize that the tooth and its pathology was guiding us towards the treatment we should perform. This being the apexification.

Therefore, the 2nd step of the new treatment plan is to perform the induction at the apical closure with calcium hydroxide replacements.

After irrigating the canal copiously, activating it for 10 seconds with ultrasound, dry it with sterile cones of absorbent paper and proceed to place the medicated calcium hydroxide (Ultracal Ultradent), changing it to the month and every three months.

To carry out this technique, the collaboration of the patient or tutor is fundamental if he/she is a minor (as in this case) since it is fundamental and vital for the success itself, the constant assistance of the patient until radiographically and clinically evidencing the closure apical.

To promote apical closure, the technique of apexification with calcium hydroxide is used (Figure 3a and 3b), replacing it approximately every three months, taking advantage of its power, antibacterial and mineralized tissue stimulator.

At 10 months, to properly evaluate the progress, a new tomography is requested, which reports a partial apical closure (Figure 4).
For this technique, the canal was filled from the middle third to the apical zone with Biodentine, creating a resistant, biocompatible and bioactive surface (Figure 5a). As previously recommended, while placing the Biodentine in the apical third, it is suggested to coat the root walls with the same material to reinforce them (Figure 5b).

To rehabilitate the tooth, due to its abnormally wide channel it was necessary to think the most appropriate way and not only for an aesthetic issue, but it had to be done with an implement that helps with the distribution of forces at the time when the tooth enters into occlusion, rehabilitating it properly.

For this purpose it was thought to use a fiberglass pole, but due to the large volume of the residual channel, a single pole could not be used, for which a technique of multiple fiber posts was used (Relyx Fiber Post of 3M ESPE), with dual cement (RelyX U200), acid etching (3M ESPE Scotchbond) and adhesive (3M ESPE Single Bond Universal), completing the spaces with light curing resin (Filtek Z350XT from 3M ESPE), providing the tooth with bending and resistance necessary to rejoin the stomatognathic system and give a better future to the tooth, from the point of view of the distribution of forces, functionality and ultimately aesthetics (Figure 6a-6d).
The favorable evolution was observed in the last clinical and radiographic control completed 3 years after the endodontic therapy was performed (Figure 8a-8c). The tooth 1.1 is asymptomatic and fully functional.

Discussion

The Dens Invaginatus is an anomaly of the development of the tooth, during the formation of the tooth the organ of the enamel folds in the dental papilla, which results in the formation of a cavity lined with enamel and dentine that invaginates and projects into the pulp. This cavity acts as an area of stagnation of organic matter and provides an environment conducive to the proliferation of cryogenic microorganisms, which could promote bacterial contamination of pulp tissue [1,2].
Several clinical cases of ID patients have been refilled, this pathology represents a great challenge for clinicians, since invagination usually by palatal obstructs the conventional endodontic access route to the canal system and therefore complicates an adequate chemo preparation, mechanical and its subsequent three-dimensional obturation [13-16].

The treatment of teeth with ID varies depending on the severity of the case, the etiology of the pathology, the concurrence with regularity, the clinic, the possibility of accessing all the spaces to be treated, the permeability of the channels, the skill or familiarity of the clinician to perform the different treatments and the updated scientific reports, which provide the guidance and support to perform, for example; preventive sealants, conventional root canal treatments (apexification or artificial apical closure), surgical treatment, intentional reimplantation until extraction and implant placement [4,6-8]. However, much of the success depends on a timely and adequate preventive diagnosis, through the use of computed tomography.

The present case corresponds to a male patient, 7 years of age, with a right upper central incisor tooth with a diagnosis of acute apical abscess (submucosal abscess) of cariogenic etiology that has a type II ID and, of course, incomplete apexogenesis. The endodontic treatment in a tooth with incomplete apexogenesis is quite a challenge, even more so when it suffers from an alteration of the development as in this case. Teeth with open and thin-walled apex complicate conventional endodontic treatment, due to their unfavorable crown/root relationship, their thin dentinal walls are susceptible to fractures, in addition to the lack of apical stop that would cause any filling material to invade tissues peri-radicular.

Under the clinical circumstances described above, the technique of apexification was performed with the use of calcium hydroxide, changing it approximately every three months. On the other hand, certain obstacles had to be overcome, for example; achieve a correct and adequate chemical-mechanical preparation of the root canal with 5.25% sodium hypochlorite with a safe irrigation technique, such as the one that uses negative pressure, due to the inherent risk of driving the irrigator to the periapical area. When being in front of a channel with so many irregularities and irregularities without counting on the amplitude with lodges a great amount of necrotic material, the cleaning is essential, for which the irrigant potentiation with ultrasound; it was key.

The obligations of the parents, fell on the discontinuity of the treatment of the patient what forced to redesign the plan of treatment realizing an apical barrier. Here an important point was to decide what would be the material of choice if MTA or a Biodentine. It was decided to use the Biodentine, since it has the ideal chemical and physical characteristics, which makes it the material of choice, with a flexion and hardness index similar to dentin, with an adequate setting time, biocompatible and bioactive. The setting in 12 minutes made possible that it could be rehabilitated in the same appointment in which it was decided to close the apex, decreasing the risk of contamination between appointments and for better patient comfort [17-21].

Conclusion

The case presented here illustrates the success of the non-surgical management of a type II DI with an open apex, and demonstrates that conservative endodontic treatment should be the treatment of choice instead of apical surgery or other invasive procedures such as reimplantation or intentional removal. implant placement.

In cases with immature roots, the use of adequate methods of intracanal disinfection and revascularization can be successful. We should obtain good results from the biological, physical, mechanical and psychological point of view; after having eliminated the infectious focus, besides incorporating the use of bioactive and biocompatible materials, which stimulate the mineral apposition on the apex and finally, the realization of the conservative restoration that redistributes the masticatory forces. Certainly the manufacture of a custom fiber post, would also have been a correct choice.

It would not have been impossible to face this challenge without the collaboration of the patient, his parents and the understanding of biology and his reaction to different materials and events.

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To think about different options of the same treatment, it is necessary to know the advantages, disadvantages, skills of the clinician and familiarization with the different procedures to be used before each decision. The execution of the treatment plan does not always fit exactly as planned, nor is it free of surprises. This is why the operator must be adequately prepared to solve possible eventualities beyond its control.

**Bibliography**


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