



Emanuela Carla dos Santos  
(Organizadora)

# Odontologia: Serviços Disponíveis e Acesso

**Emanuela Carla dos Santos**

(Organizadora)

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## APRESENTAÇÃO

Observar a evolução nos serviços prestados pela Odontologia é algo muito interessante e até mesmo admirável. Historicamente, sabemos que essa área era conduzida por um sistema rústico, onde ‘cirurgiões-barbeiros’ realizavam os procedimentos inerentes ao que era considerado saúde bucal na época. Com o passar dos anos, esse sistema foi lapidado e agora disponibilizamos de tecnologia e técnicas muito precisas, que são aprimoradas cada vez mais.

A odontologia hoje está serviço da sociedade, não só na área da saúde bucal propriamente dita, mas também atuando de forma incisiva em diversos campos, buscando contribuir para melhoria da saúde em geral e qualidade de vida da população.

Diante disto podemos perceber que a Odontologia tem expandido suas fronteiras, aumentando os serviços disponíveis, o que favorece o acesso da comunidade à esta ciência.

Esta obra demonstra a evolução, citada anteriormente, trazendo artigos científicos sobre o desenvolvimento e melhoria de técnicas, áreas revolucionárias dentro da ciência odontológica, como atuação do Cirurgião-dentista na Oncologia e ambiente hospitalar, estética, plataformas digitais, saúde coletiva vista por uma nova perspectiva e relatos de casos.

Desejo a você, leitor, que estas páginas contribuam com seu crescimento profissional e possibilite percepção de novas perspectivas.

Ótima leitura!

Emanuela Carla dos Santos

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## TREATMENT OF INCOMPLETE RHIZOGENESIS THROUGH PULP REVASCULARIZATION TECHNIQUE. A CASE REPORT

**Evelynn Crhistyann Medeiros Duarte**  
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**Aurino Fernandes De Brito Júnior**  
**Márcilio Dias Chaves De Oliveira**  
**Fábio Roberto Dametto**

**ABSTRACT:** To reestablish the root development through pulp revascularization technique. Patient E.T.T.S., 9 years old, presenting the upper left lateral incisor (n=10) with root formation interrupted by trauma, which was diagnosed with necrosis and incomplete rhizogenesis. The pulp revascularization protocol was performed, by using a combination of antibiotic paste with ciprofloxacin, metronidazole, and amoxicillin to promote disinfection of the root canal. To seal the root canal and to avoid contamination after the clot induction, MTA was used. After the technique performance, we noticed regression of periapical lesions, fistulas, and painful symptomatology. Besides, there was an increased thickness of the root walls, decreased apical opening, delineation of the lamina dura, and tooth dimming. Amoxicillin obtained success on root disinfection on the cases executed, and did not promote tooth dimming, which was related, possibly, to the

MTA use. Therefore, we observed that collagen induction is one of the predetermining factors to the formation of a new tissue.

**KEYWORDS:** Neovascularization, Physiologic. Dental Pulp Necrosis. Regeneration.

### INTRODUCTION

Conventional endodontic treatment consists in the use of chemical and mechanical processes aiming to eradicate an infection, being of difficult execution because of the root canals complexity. Yet, this process may become even more complicated in cases of teeth with incomplete rhizogenesis. In these, the root canal walls are fragile, and the apex is immature, which hinders the root canal filling, since the material might overflow, bringing damage to periodontum. This incomplete development of the root may be caused due to an interruption of the cellular differentiation of the Hertwig epithelial sheath, which in the presence of stimulus, such as a trauma, might stop depositing minerals, preventing the root to be matured (FRIEDLANDER et al., 2009).

A way to heal the difficulty of treating teeth with open apex is through the apexification technique. This procedure is performed in devitalized pulp, and it is capable of only promote the apical closure, which may be

obtained through the placement of a bulkhead of MTA (mineral trioxide aggregate), or periodical switches of calcium hydroxide, favoring the conduct filling. Otherwise, the conduct walls remain fragile, and there is no tissue gain Rafter (2005). However, if the Hertwig epithelial sheath did not suffer huge damage, yet is possible the maturation to be completed with the continued tissue deposition, which turns the root walls more resistant mechanically. This result may be obtained through techniques such as apicogenesis, and pulp revascularization (RAFTER, 2005; ZHANG e YELICKL, 2010; HUANG, 2009).

Apicogenesis is the physiological radicular complementation in teeth which present pulp tissue still vital, at least in the apical section of the canal, with viable existence of the Hertwig epithelial sheath, aiming to encourage the physiological development and the continuous formation of the end of the root. However, this process can only be possible in young patients because these present higher quantity of stem cells than in patients of more advanced age, since those cells are of fundamental importance to the occurrence of the physiological development of the root (FRIEDLANDER et al., 2009; RAFTER, 2005; MOLERI et al., 2011).

Nevertheless, despite of apicogenesis is being utilized on teeth with vital pulp, some studies have been shown that this protocol might be applied on teeth which theoretically are no longer vital (HUANG, 2009; NOSRAT et al., 2011; CEHRELI et al., 2011). This procedure involves the knowledge of concepts of cellular engineering, once the pulp was extinct by the infection. Although, if there is preservation of the Hertwig epithelial sheath, the tooth might continue its evolution since there is some stimulus<sup>2,4</sup>. This method is denominated pulp revascularization.

To obtain success from this regeneration, several protocols of root canal disinfection have been reported, and the most common one is utilizing a plentiful irrigation with sodium hypochlorite (NaOCl) and post combination of ciprofloxacin, metronidazole, and minocycline as intracanal medication<sup>8</sup>. After disinfection, the antibiotic mixture is removed, and a apical bleeding is induced to produce a blood cot in the canal. Then, the opening of the dental pulp cavity is sealed with MTA, and a permanent sealing of the pulp chamber is made to avoid recontamination (RAFTER, 2005).

This antibiotic mixture, described by Hoshino, et al. (1996), works very well, eliminating bacteria amount of the infected dentine; however, it shows disadvantages, due to the presence of minocycline, once it derivates from tetracycline, which reacts with calcium ions by chelation and form an insoluble complex, causing the coronal dimming. In this way, some variations of this mixture have been suggested, such as the replacement of this antibiotic by Fosfomicin (KIM et al., 2010; TROPE, 2010) or by amoxicillin (THOMSON e KAHLER, 2010), avoiding the tooth dimming.

Since the description of the revascularization technique, several cases reports and studies about the results of this treatment demonstrated the regenerative potential of this protocol. As evidenced by the increased root length, the thickening of the root wall, and apical closure in different degrees, being a promissory technique to the

development of these immature teeth with pulp necrosis.

In this way, based on the assumption in which the replacement of minocycline to amoxicillin, in the triple antibiotic paste, does not influence on the clinical success of revascularization and avoids the tooth dimming, the aiming of this case report was: to evaluate the regenerative potential of permanent immature young teeth with pulp necrosis, which had as irrigator sodium hypochlorite 2,5%, triple antibiotic paste composed by ciprofloxacin, metronidazole, and amoxicillin; to observe clinically the regression of the painful symptomatology; Radiographically, to analyze the periapical lesion repair, the thickening of the root canal walls through deposition of mineralized tissue, and the completion of apicogenesis.

## CASE REPORT

Patient E.T.T.S., 9 years old, masculine gender. He was sent off to the treatment project of incomplete rhizogenesis teeth through the pulp revascularization technique from the dental college of UFRN, to perform the dental treatment of the upper left lateral incisor (n=10), which had its root formation interrupted by a trauma. In the anamnesis, the patient's tutor claimed that the child was not allergic to any medication. In the clinical exam, was observed a fractured dental crown, it had a temporary sealing, and intracanal medication; a fistula was present, and painful symptomatology. Thermal test was performed with negative response. On the radiographic exam, a periapical lesion was observed, and incomplete rhizogenesis. The materials utilized to the pulp revascularization technique were sodium hypochlorite 2,5 (Ciclo Farma, SP - Brazil), and sterile saline solution 0,9 (VIAFLEX, SP- Brazil) as irrigators. The triple antibiotic paste, composed by ciprofloxacin 500mg, metronidazole 125mg, which were manipulated in FARMAFÓRMULA<sup>®</sup>, compounding pharmacy, RN- Brazil, and amoxicillin 500 mg (Medley, SP- Brazil), all in capsule, as intracanal medication. MTA (Angelus<sup>®</sup>, PR-Brazil) to seal the conduct. Coltosol<sup>®</sup> (Coltene, RJ-Brasil) to avoid infiltrations. And to promote a complete coronal seal it was utilized composite resin Z 350 Filtek (3M ESPE, SP-Brazil), color A3, after the application of phosphoric acid 37% (DFL, RJ-Brasil) and Single bond 2 Adhesive (3M ESPE, SP-Brazil). The anesthetic utilized was Mepivacaine 3%, without vasoconstrictor (DFL, RJ-Brasil), not to harm the clot induction. The radiation source is a Procion brand, of 70 kV and 8mA.

The criteria to the technique execution is that the patient presents permanent tooth with no vital pulp with indication of apexification plus age group from 6 to 18 years old. Patients who presented any pathology, history of uncontrolled diabetes, immunosuppression, severe asthma, chronic systemic diseases, eating disorder (anorexia, bulimia or malnutrition), oral pathology, periodontal disease, and corticosteroid treatment during the last three months, did not fit in the treatment profile. The patients participated voluntarily after signed the informed consent form (TCLE), which was previously submitted to the Committee of Ethics and Research of the

Federal University do Rio Grande do Norte (UFRN Campus Central) and approved through protocol number: 168.448.

Once established the diagnosis and being the patient included in all inclusion criteria, the treatment was started. The process was divided in two sessions, on the first one, being the first session done in 05/11/2014 in which was established the real length of the tooth, by introducing K-type files up in the apparent length and decreasing 3mm (INGLE,1957) which led to CRD of 21mm, it was done anesthesia with mepicavaine 3%, without vasoconstrictor, followed by dental dam, access to the pulp chamber, odontometrics, irrigation by 20 mL of NaOCl 2,5% , drying with absorbent paper cone, and filling of all conduct with pasta de triple antibiotic - composed by 10mg of ciprofloxacin, 10mg of metronidazole, and 10mg of amoxicillin - manipulated on a glass plate, totalizing 30mg of mixture antibiotic with 2 mL of saline solution 0,9% until reaching consistency of paste. It was inserted in all extension of the root canal with assistance of K-type files up #30, then it was made the acid attack, with phosphoric acid 37%, and application of Single Bond 2 Adhesive System and the coronal seal with composite resin Filtek Z 350, color A3, and periapical radiography to case follow up.

On the second session, fifteen days later, in 19/11/2014, the patient was reevaluated, and being the tooth asymptomatic and with absence of clinical signals, the canal was reassured and examined. On the absence of exudate, the anesthesia with mepivacaine 3% was performed, without vasoconstrictor, not to harm the clot formation, followed by dental dam, removal of the restoration, and removal of the triple antibiotic paste from the conduct under irrigation of 20 mL of sodium hypochlorite 2,5%, followed by irrigation with 20 mL of sterile saline solution 0,9% and the assistance of a K-type files up through slight movements. Could be observed the disappearance of the fistula.

Being the conduct antibiotic free, drying was performed with sterile absorbent paper cones. Then, a bleeding was induced by K-type files up #20, which exceeded the actual tooth length previously established. Thereby, formed a intraradicular visible clot, being the conduct sealed with MTA at the cervical and medium thirds, which was manipulated on a glass plate with distilled water, that comes in MTA kit, and inserted in the conduct with a spatula and condensed by a heated type Paiva. After deposition of itself, above MTA was placed a cervical tampon with Coltosol® to seal and to avoid infiltrations. Then, a coronal restoration was made with composite resin Z 350 Filtek, color A3, however previously was done the application of phosphoric acid 37%, and Single Bond 2 Adhesive System. There were made follow ups of three months, one year, and two years, through periapical radiographies. (Fig. 1)



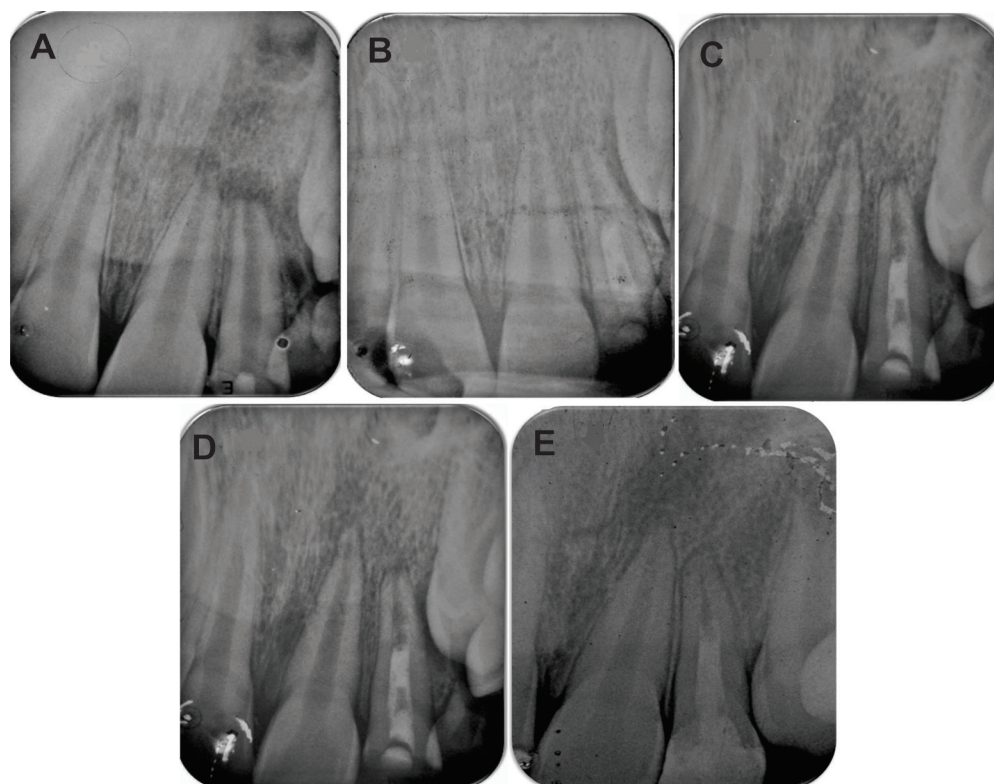


Figure 1- A) Initial radiograph showing periapical lesion and incomplete rhizogenesis. B) 15 days after - regression of the periapical lesion, corresponding to the period in which the mass remained uncondensed, and the middle third filled with MTA in left lateral incisor (n=10). C) Control of 3 months - beginning of the hard blade design and deposition of tissue in the Apical region. D) Control of 1 year - reduction of the lumen of the conduit and thickening of the root walls. E) 2 years - complete apical closure showing increased tissue deposition and thick walls, hard blade delineation and complete regression of the lesion.

The results found after the clinical and radiographic showed the regression of periapical lesions and painful symptomatology, decreasing of apical opening, increased thickness of root walls, delineation of the lamina dura - with decrease of thickness, due to tissue deposition and the coronal dimming, being this last one found clinically only after the clot formation and confection of cap with MTA.

## DISCUSSION

Pulp tissue revascularization on a tooth with periapical lesion and necrosis was considered impossible to reach. However, if the root canals system is effectively disinfected and a favorable environment is created, the regeneration of the odontogenic tissue might occur, which will result in tissue growth (DING et al., 2009). The key factor to reach success in this process is the root canals disinfection. Since the root walls are thin and weakened in teeth with incomplete radicular formation, the disinfection depends, exclusively, on the irrigators and intracanal medicaments. Thereby, the instrumented root canal was not performed, in accordance to the studies of Banchs and Trope (2004), in which the authors affirmed that mechanical instrumentation should not be done to not weaken even more the dentinary walls of the teeth with incomplete rhizogenesis, and, consequently, do not decrease its mechanical resistance.

In this study, sodium hypochlorite 2,5% was used as irrigator to promote conduct disinfection, once it presents an antimicrobial efficacy. This efficacy is due to its high pH, which interferes on the integrity of the cytoplasmic membrane of the bacteria and inactivates its enzymes irreversibly (ESTRELA et al., 1995). Thereby, there is a consensus in all researches (KIM et al., 2010; LOPES et al., 2010) that the initial step of disinfection of the root canals, utilizing a plentiful irrigation with sodium hypochlorite 2,5%, is a key to the success of this revascularization technique.

However, this initiated disinfection should be complemented with the combination of the antibiotic paste described by Hoshino, et al. (1996), composed by ciprofloxacin, metronidazole, and minocycline. The use of these antibiotics in combination is essential, once they individually are not effective on bacteria present on root canals (SATO et al., 1996). Yet, according to Kim, et al. (2010), due to the presence of minocycline, semi-synthetic derivative of tetracycline that reacts with calcium ions via chelation, there is the formation of a insoluble complex promoting the coronal dimming. In this way, the present study used amoxicillin in replacement of minocycline, to avoid this coronal dimming, keeping the paste with the antibiotic mixture on the conduct for fifteen days.

After this period, the clot is induced, which characterizes a important factor so the new tissue is deposited. This clot is made through a overinstrumentation on the apical region, which is also described on Banchs and Trope (2004) protocol. The clot will serve as a framework to the complementation of root development, being observed in radiographic exams of the present study as well as was described by Bansal and Bansal (2011).

Subsequently the clot induction there is the MTA insertion, which will perform the physical propriety of conduct sealing, and biological propriety, inducing formation of mineralized barrier. Choosing this material is related to its proven proprieties on Shabahang, et al. (1999) and Whitterspoon, et al. (2008) studies, which affirm that, when placed in contact with the periapex, MTA induces the formation of hard tissue, has high degree of compatibility, besides presenting lower setting time when compared to calcium hydroxide. Since this last one, according to Shah, et al. (2008), needs periodicals switches and might form a barrier more porous and induce only the apical closure instead of the end of the root formation. Besides, Andreasen, et al. (2002), affirmed that, calcium hydroxide may weaken the root, when left for long periods in root canal, due to its proteolytic and hygroscopic proprieties.

Thereby, MTA presenting sealing proprieties superior to other materials and reduced infiltration degree, capacity of set in the presence of organic matter, biologically compatible, and capacity of promoting tissue repair, was the material chosen in this present study (FRIEDLANDER et al., 2009; ZANG e YELICKL, 2010; CHALA et al., 2011; BEZGIN et al., 2012; SAEKI et al., 2014). Although, it is important to notice that we observed in the clinical procedure, extreme difficulty of insertion of MTA, mainly on larger conducts, occurring a superficial mixture of itself with blood clot; however, this fact did not involve failure in the case performed.

The clinical and radiographic results from this research showed that, after an entire protocol test, it was observed the lesion regression, and mineralized tissue deposition, starting the formation of calcified apical barrier, as well as the increased thickness of the root walls. Consequently, besides the reinforcement of the walls, was observed the delineation of the lamina dura with decreasing of its thickness. These factors are in accordance with the analyzes made by Bruschi, et al. (2015) and the research of Banchs and Trope (2004), who also noticed in the cases reports, the end of root formation and the reinforce of the root walls by deposition of hard tissue, turning the tooth more resistant to fracture. Thus, may be affirmed that, the absence of infection is an indicative of success, so that from there the process of repair may be initiated (TROPE, 2010). This repair observed was related to thickening of root wall, delineaamento da lâmina dura, and apical closure (CHANDRAN et al., 2014).

Besides, coronal dimming was noticed, despite of the replacement of minocycline by amoxicillin. This alteration on the composition of the paste described by Hoshino, et al. (1996) was tested by Thomson and Kahler (2010), who obtained success on the conduct disinfection, lesions regression, and apical closure without causing tooth dimming; that study proves only that the observation made during the fifteen days in which the pasta was on the conduct, once during this period was not seen any coronal dimming, differently from what occurs with the use of minocycline, which after 24 hours already shows some dimming (KIM et al., 2010).

The present study verified the coronal dimming only after the use of MTA. A factor also described in several studies, according to which, tooth discoloration was found when MTA was utilized to perform pulpotomies or as a biological apical barrier (KVINNSLAND et al., 2010; JACOBOVITZ e LIMA, 2008). This dimming may be greater when MTA is associated with blood (FELMAN e PARASHOS, 2013), as in the technique of pulp revascularization, in which after the clot induction the conduct is sealed with MTA. Demonstrating, that not only minocycline causes this color changing, but also MTA when associated to clot.

## CONCLUSION

Therefore, based on clinical and radiographic evidences, it may be affirmed that the pulp revascularization technique obtained success. However, it is only possible when the apical region is free from infected and inflamed tissue. Regarding to the protocol used on this present study, may be concluded that, amoxicillin showed a great result as a minociline substitute, once resulted in success of the treatment, and did not promote coronal dimming, since during the use of the pasta, was not observed color changes, being only noticed after MTA use. It was notory, as well, that clot induction is one of the predetermining factors to the formation of a new tissue.

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