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The challenge of the management of periapical lesions of large extension in the permanent immature tooth

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Abstract

The radiolucent periapical lesion of large extension, commonly called "cyst-like lesion" belongs to the family of chronic apical periodontitis. This pathological entity often poses a double challenge, particularly in the immature permanent tooth. The first challenge is diagnostic, as this type of lesion could be confused with other families of lesions or anomalies with similar clinical and/or radiographic characteristics. The second challenge is therapeutic, especially in the presence of a gaping apex making optimal root canal disinfection difficult in the presence of periapical lesions. The purpose of this work is to discuss these challenges by illustrating with two successful clinical cases.

Keywords: Immature tooth, large extension, management, periapical lesion.

Introduction

The radiolucent periapical lesion of large extension, commonly called "cyst-like lesion" belongs to the family of chronic apical periodontitis [1]. This lesion in the permanent immature tooth represents a challenge in its endodontic management. The practitioner faces a major problem; is it possible to treat the periapical lesion of large extension by ortho grade endodontic way or by surgical way. On the other hand, when the endodontic way is indicated, how to manage the case of immature tooth presenting an open apex which constitutes a large communication way with the apical lesion. The objective of this work is to answer these questions.

Diagnosis Challenge

Periapical lesions of wide extension with an endodontic origin appear radiographically as radiolucent images around the apex or the lateral canal or around the

accessory canals [2]. Nevertheless, there are similarities with other pathological entities whose radiographic expression is of radiolucent appearance at the root tip [3]: Vertical root fracture [4, 5]: a radiolucent periapical and latero-radicular image called "halo" may be present if the fracture is old, with a positive periodontal probe.- the palato-gingival sulcus which corresponds to the presence of an invagination in the center of the cingulum which continues vertically along the root and can go as far as the apex with the palatal surface of the upper lateral incisor as the preferred site [6]. The similarity with a lesion of endodontic origin lies in the presence of a positive periodontal probing on the face corresponding to the sulcus and the presence of a peri-radicular radiolucency whose extent depends on the extension of the invagination [6]. When pulpal involvement exists, a purely endodontic lesion may be associated.-periodontal abscess: characterized by the presence of pain, swelling and mobility of the tooth with a periodontal probing objectifying the presence of a large defect around the tooth with a living pulp [7]. Depending on the degree of bone destruction, the radiographic image may simulate the presence of endodontic involvement. The probing at this level is narrow, and the tooth pulp concerned may be alive or necrotic [8, 9].

The differential diagnosis with certain forms of maxillary cysts also presents a diagnostic challenge, especially in the immature permanent tooth [10]. The concrete example is that of the lateral periodontal cyst, where the positive diagnosis is based on the positive response of the pulp to sensitivity tests [11]. In immature permanent teeth, pulp sensitivity tests are not reliable, due to the immaturity of the nerves, which results in a lack of response to sensitivity tests, even though the pulp may be alive. This is called "false negatives"[11].

The first clinical case is about a female 18-year-old patient, in good general health. She was referred to the department of endodontics in Dental Consultation and treatment Center of Rabat – CHU IBN SINA, Rabat, Morocco, for the treatment of tooth #12# after undergoing emergency treatment in the emergency department, which consisted of mucosal drainage of a palatal abscess related to the tooth in question. The patient reported that she suffered a direct impact on the tooth when she was 8 years old. Clinical examination showed that 12 were intact, slightly dyschromic, and a drained swelling on the palatal side. The cold test was negative. Palpation at the vestibular level was normal but painful on the palatal side. Axial percussion was sensitive. The radiograph showed that 12 was immature at Nolla stage 8, with diverging dentinal walls and absence of cemento-dentinal junction; a radiolucent periapical image of significant extent was noted [Figure 1].

The diagnosis was an apical abscessed periodontitis at the tooth #12# caused by an old trauma on an immature tooth, which led to the stop of the root construction.

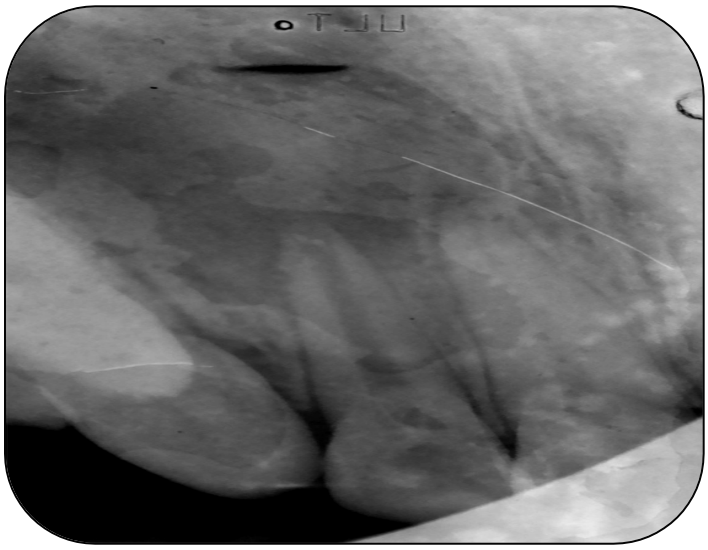

Figure 1: Preoperative radiograph showing immature tooth #12# with a large periapical lesion.

The second case concerned a 20-year old patient in a good general health. She was referred to our department for treatment of the tooth #22# after decompression of a cyst related to this tooth. Clinical examination showed that 22 had a defective metal-ceramic crown, and a drain has been placed in the vestibule opposite the apex of 22. Palpation of the vestibule floor and axial percussion were sensitive.

The radiograph showed that #22# was immature at Nolla stage 8, with diverging dentinal walls and the absence of a cemento-dentinal junction, in addition to defective endodontic treatment (significant gutta percha cone protrusion and low density). A radiolucent periapical image was present [Figure 2]. In this case, the diagnoses were a chronic apical periodontitis in #22# caused by a defective endodontic treatment on an immature tooth, which caused the stop of the root construction.

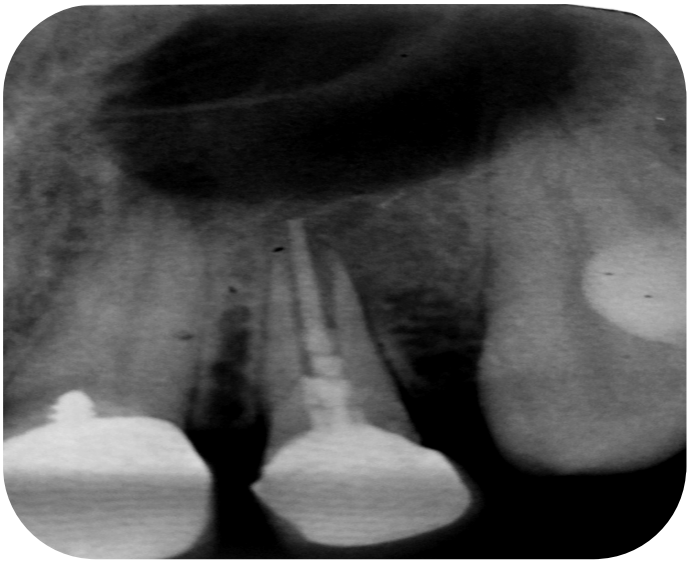

Figure 2: Preoperative radiograph showing immature tooth #22# with a protrusion of the root canal filling and a large periapical lesion.

Treatment Challenge

The apical foramen is the main pathway for the exchange of irritants between the pulp and the deep Periodontium, leading to periapical lesions in case of endodontic infection [12, 13]. The lateral canals are related to the appearance of latero-radicular lesions of endodontic origin [14]. The accessory canals are mainly involved in the development of inter-radicular lesions in the furcation area of multi radicular teeth [15]. In the case of immature teeth, the endodontic system is completely exposed to the deep Periodontium and no physical barrier exists. As a result, infection with an initial endodontic origin cannot be confined within the canal and spreads easily to the deep Periodontium tissues [16]. This periapical lesion, known as extra-radicular, can easily escape all the therapeutic manoeuvres used. This constitutes the first challenge encountered by the practitioner when managing this type of lesion [16].

During the various therapeutic maneuvers, the risk of backflow necrotic debris and extrusion of irrigation solutions beyond the periapical area is high due to the lack of an apical barrier, which causes additional bacterial and chemical aggression [17, 18]. This can hinder the repair potential of the peri apex [19].

In the case of periapical lesions of large extension, canal drying is often difficult to obtain because of the presence of canal serosities, resulting from the acidity due to the inflammatory reaction at the periapical level. Therefore, it is often recommended to use intra-canal medication based on calcium hydroxide to alkalize the environment [20]. Although calcium hydroxide has many advantages, it is criticized for weakening the root canal walls by affecting the chemical composition of the root dentin, and by this mechanism, it increases the risk of root fracture [21]. This is due to the fact that the thickness of the root dentin is less than that of the mature permanent tooth on the one hand, and on the other hand, the dentin present is characterized by its immaturity and therefore by a lower degree of mineralization [22]. Another difficulty is encountered during root canal filling. The absence of an apical barrier means that there is no dentin

base for the root canal filling material and therefore an increased risk of the filling material protruding. An additional Apexification step is then required [23].

For the first clinical case, the treatment consisted of root canal trimming using the coronoapical technique under abundant irrigation with 2.5% sodium hypochlorite. Intracanal medication based on calcium hydroxide in the form of a magistral preparation was applied for 3 weeks and then renewed for another 3 weeks to obtain a dry canal without serosities. Apexification therapy was necessary to create an apical barrier against extrusion of the final root canal filling material. A root canal obturation by the vertical hot condensation technique was performed followed by a functional and watertight coronal restoration by laminate technique (Glass Ionomer Cement and composites).

For the second clinical case, the treatment was based on endodontic retreatment followed by Apexification therapy to create an apical barrier against extrusion of the final root canal filling material. Temporary medication with calcium hydroxide for one week was performed to optimize root canal sanitation, to remedy the periapical serosities often present in such clinical situations, and to alkalinize the tissue pH. Apexification therapy with MTA© consists of building up a 3 to 5 mm layer of MTA©, and after it has set, sealing the rest of the canal space with gutta-percha by hot vertical condensation. This ensures that the MTA© remains in the canal permanently. After making the access cavity, determining the working length with reference to the shortest root canal wall, the root canal shaping was performed under irrigation with 2.5% sodium hypochlorite and a temporary medication with calcium hydroxide was left in the canal for 2 weeks. After this time, the calcium hydroxide was removed under abundant sodium hypochlorite irrigation and root canal instrumentation. Then the canal was dried with a paper tip. The vertical rammer is selected so that it is introduced into the canal without friction on the canal walls to the desired length (working length - 4 mm, the 4 mm corresponding to the desired thickness of the apical plug of MTA©). The MTA© was then mixed with sterile water and placed at the root canal entrance using an amalgam holder. Excess moisture was absorbed with a paper tip (thick gauge) used upside down. The MTA© core is then condensed with the selected vertical rammer towards the apical end of the root. An apical plug of 3 to 5 mm was thus created and the result was evaluated by a control radiograph, which showed a tight plug of MTA© (If this one showed that the plug of MTA© was inhomogeneous or the apex was not sufficiently plugged, it is possible to remove the MTA© by rinsing with sterile water) A moistened sterile paper tip was then placed in the canal in contact with the MTA, and the access cavity was temporarily sealed with a waterproof dressing (fast-setting eugenate or CVI).

The root canal filling can be performed as soon as the MTA was completely set, in theory 4 to 5 hours later, but for practical reasons, during a second appointment, the provisional coronal filling was removed, the setting of the MTA© was checked and then the root canal filling with gutta-percha was performed by the hot vertical condensation technique.

Follow-Up

It is quite logical to recognize that any chronic pathology, that has taken time to establish itself and cause tissue damage, would also need time to heal and repair the tissue damage caused [24]. Hence the importance of instituting a rigorous clinical and radiographic follow-up, the objective of which is to follow the regression or progression of the lesion whether clinically or radiographically, but also to

evaluate the prognosis in the short, medium, and long term in order to be able to choose other alternatives and to intervene, if necessary, at the right time [24].

The healing kinetics of periapical lesions is variable. Thus, after one year, 89% of the lesions likely to heal already show signs of repair (reduction in lesion size), but only 50% of these lesions heal completely within one year. At two years, the majority of lesions heals or continues to show signs of repair by reduction in lesion size. Occasionally, this reduction may continue for 4 or 5 years, with younger patients having a better prognosis than older patients [25].

For these clinical cases, clinical and radiological monitoring was instituted to follow the evolution of the periapical radiolucency. The follow-up of the cases revealed a significant regression of the lesion after 18 months for the first case [Figure 3] and 24 months for the second case [Figure 4].

Figure 3: 18-month-Control radiograph showing complete healing of periapical lesion in the tooth #12#.

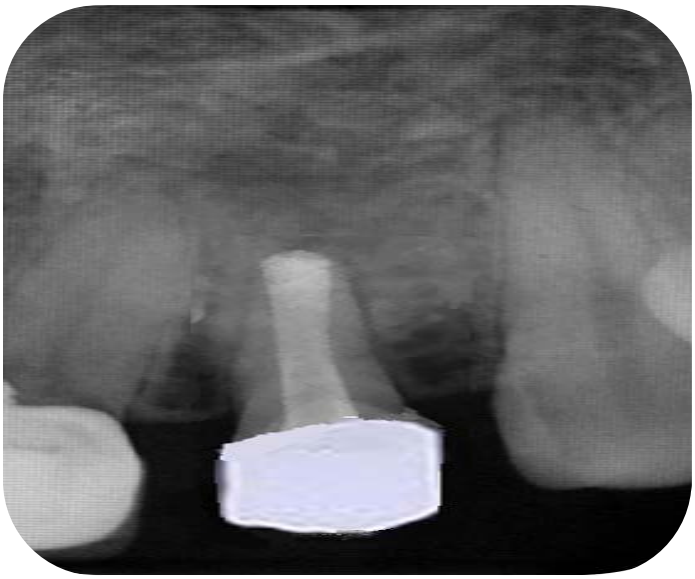

Figure 4: 24-Month-Control Radiograph Showing Complete Healing Of Periapical Lesion in the Tooth #22#.

Discussion

Periapical radiolucent lesions of endodontic origin are lesions associated with pulpal necrosis or defective endodontic treatment, which can trigger chronic apical periodontitis in which a state of equilibrium occurs between the body's defenses in the periapical region and the pathogen in the intracanal position [1]. This state of equilibrium may last for months or even years without any symptoms, and the discovery will be fortuitous during a routine radiographic examination or during an infectious reheating in case of phoenix abscess. This defense reaction of the organism at the periapical level is both defensive (prevents the dissemination of the pathogen in the organism) and destructive (destruction of periapical bone tissue) [1]. Faced with the radiolucent image, the question that arises is whether the tooth should be treated with an ortho grade endodontic treatment or a surgical treatment.

Histological studies done on extracted necrotic teeth with radiolucent periapical images have shown that in 90% of cases it is either a granulation of the tooth or it is either a

granuloma, an epithelio-granuloma, or a pocket cyst, which is treated endodontically by the ortho grade approach; and that only 10% of cases present a true cyst which requires surgical treatment. Therefore, in the case of a necrotic tooth with a peri-apical radiolucency image, it is advisable to start endodontic treatment with orthograde endodontic therapy and to follow up clinically and radiographically to assess the need for surgical treatment [14, 18].

For immature teeth, Apexification therapy is necessary. The gold standard is calcium hydroxide. Studies show a high success rate (> 75%) in building the apical barrier. Thanks to its antiseptic properties, it also allows the resorption of apical lesions. This technique requires repeated application of calcium hydroxide in the canal until apical closure, which occurs on average between 8 and 24 months [20]. However, this technique is associated with a number of drawbacks. It requires a large number of appointments and makes the follow-up of patients uncertain due to lack of attendance [18, 20]. Since the root canal treatment and the final restoration are performed several months after the beginning of the treatment, the risk of root canal reinfection due to the loss of the temporary filling is increased. Another major disadvantage of using calcium hydroxide is its long-term effect on the structural integrity of dentin. Several studies have shown that it decreases the root fracture resistance of dentin by 40-50% and that it also causes dentin, which can lead to coronal fractures [21].

The Mineral Trioxydate Aggregate (MTA), on the other hand, compensates for some of these disadvantages and risks. Indeed, this material allows obtaining an immediate apical sealing, allowing performing without waiting the root canal filling with gutta percha and the definitive coronal reconstruction. Studies show an excellent success rate of apical closure, over 80%, in a reduced number of sessions compared to calcium hydroxide, which does not pose the problem of regular follow-up [26].

Biodentine® has excellent properties, resembling the ideal material with emphasis on its biocompatibility, marginal sealing and mechanical strength. However, there is still little clinical experience or sufficient evidence for its use in this setting. In addition, the doses are often too large for a dental procedure, which leads to a significant loss of and its cost is also very high [26].

Conclusion

Extensive periapical lesions of endodontic origin are well studied clinical entities nowadays. They may be caused by pulp necrosis or by iatrogenic endodontic therapy, the main etiology, namely bacterial contamination of the endodontic system, is no longer in doubt [1, 2].

The challenge in dealing with this type of lesion on immature teeth is to eradicate the root canal infection by adequate endodontic therapy and to isolate the endodontic system by a three-dimensional hermetic root canal filling and an occlusive coronal restoration [19].

Periodic follow-up, based on the evolution of the symptomatology and on retro alveolar radiographs, will allow to evaluate the success of the therapy undertaken [13]. In situations where the lesions are refractory, endodontic surgery will remain the endodontic surgery will remain the last resort [13].

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