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Case Report

Non-Surgical Management of Extrusion of a Root Canal Material into Periapical Tissues: A Case Report

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Abstract

Extrusion of root canal sealers may cause damage to the surrounding anatomic structures. Clinical symptoms like pain, swelling and paresthesia or anesthesia may be present. The purpose of this presentation is to describe a conservative management of root canal sealer penetration into periapical tissues. A 17-year-old female underwent root canal treatment of her right maxillary second premolar due to a tooth decay, involving the pulp chamber. A postoperative X-ray revealed the presence of a root canal material beyond the root apex within surrounding tissues. The patient reported neither pain nor other complains. Radiographic examination after 4 months showed complete resorption of the root canal sealer and healing of the periapical area without performing any surgical management. That result was confirmed a year later by the same imaging technique examination. In cases of root canal sealer extrusion, surgical management should be proposed only in association with clinical symptoms or with radiographic evidence of increasing periapical lesion.

Keywords: Foreign body; management; maxillary sinus; root canal materials; tissue reaction

Introduction

Endodontic therapy is performed in order to enter the root canal system, alleviate the pain, and eliminate infection from within the tooth. Ideally, the filling material should reach to the root apex, without extending into periapical tissues or other neighboring structures. However, sometimes, over-instrumentation of a root canal with manual or rotary instruments, allows the extrusion of sealers, dressing agents, irrigation solutions and microorganisms out of the tooth into the surrounding anatomical structures and periapical tissues [1]. Although small material extrusions are generally well tolerated by the peri radicular tissues, clinical symptoms such as pain, swelling, nerve conducting disorders or infection (even such as aspergillosis in case of penetration into maxillary sinus) may appear [2–5]. Generally speaking, there are four possible types of factors considered to cause tissue damage and lead to the following problems: neurotoxic effects, because of the chemical nature of the products used to clean or fill the root canals; mechanical trauma from over-instrumentation; a pressure phenomenon from the presence of core filling material or sealer within the periodontal space, and overheating of tissues because of incorrect warm condensation techniques [2,6,7]. All these can initiate an inflammatory process, which may lead to treatment failure. Generally, the normal therapeutic sequence for the complications mentioned above, is firstly to control pain and inflammation, and then, whenever possible, to surgically eliminate the cause [6]. However, total resolution of pain and reduction or disappearance of paresthesia after a non-surgical management have been reported [4,5,8,9]. The aim of this paper is to describe a case of endodontic obturation material penetration into periapical tissues and the recovery outcome, following non-surgical management.

Case Report

A 17-year-old woman was referred dental treatment of her right maxillary second premolar due to a clinically established and radiographically confirmed tooth decay of its distal part (Figure 1). After removing the carious tissues, the endodontic preparation was carried out by cleaning and shaping of the root canal. The latter

was subsequently dried and filled with Calcipast (PPH Cerkamed/ Poland) – calcium hydroxide paste – as a temporary medication and the crown preparation was closed by temporary obturation (Cavit G 3M ESPE/Germany). According to the manufacturer's instructions, after 30 days it was obturated definitely with Endomethasone N (Septodont/France) – a radiopaque zinc oxide eugenol-based endodontic cement, that is neither resorbable nor retractable. The postoperative periapical X-ray revealed extrusion of the radiopaque root canal material beyond the apex (Figure 2). Because of the two-dimensional nature of this image technique, it was not possible to identify with confidence whether the sealer is localized within the peri radical tissues only or it had penetrated into the maxillary sinus. The patient was duly informed about the investigation result, the potential complications, the possible treatment options and the need for long-term regular follow-up and additional imaging investigations in case of specific clinical symptoms. Based on the lack of any complains, the patient opted for a conservative management and therefore an anti-inflammatory regimen (Aulin ® sach 100 mg, b.i.d, in case of pain), periodic follow-up visits were prescribed and the final crown restoration was done by one-component self-etching light-cured adhesive (GC EUROPE G bond) and light-cured posterior composite restorative (GC EUROPE Gradia Direct). The patient remained symptom-free and the radiographic examinations after 4 and 12 months showed complete resorption of the root canal obturation material and healing of the periapical area (Figure 3).

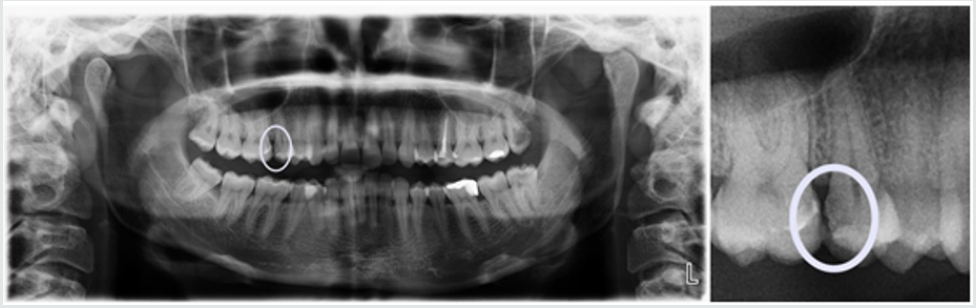

Figure 1: Pre-operative orthopantomography.

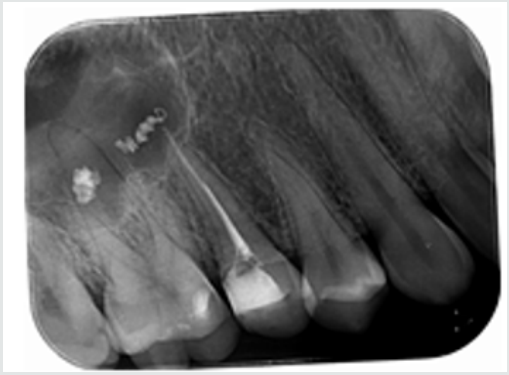

Figure 2: Postoperative periapical radiograph immediately after the obturation.

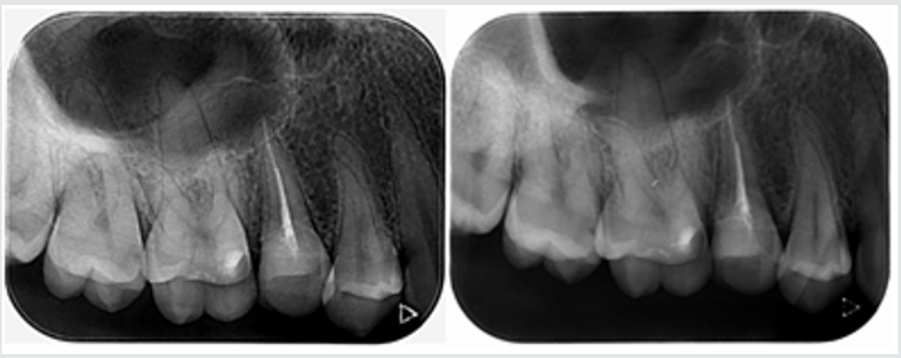

Figure 3: Postoperative periapical radiograph after 4 months and after 12 months.

Discussion

Many factors can increase the risk of sealer extrusion beyond tooth apex, like: the complexity of the anatomy of the root canal system, an immature canal apex formation or a root tip resorption, the use of lentil spirals, excessive amount of sealer, an excessive compaction force, hydrostatic pressure, over-instrumentation, etc. [10, 11]. Especially due to over-instrumentation, most of the case reports suggest that sealer extrusion is more likely to happen in premolars and molars [12], as in the presented case. Mechanical and chemical injuries associated with over-instrumentation, apical extrusion of irritants or sealers together with the microbial contamination from the root canal system, commonly lead to an acute [13] or chronic [14] inflammatory response in the peri radicular tissue. The frequency of flare-ups ranges from 1.4% to 16% and their intensity depends on the number and virulence of extruded microorganisms [15]. Forcing microorganisms and their products into the peri radicular tissues can generate pain and swelling, as well as an inflammatory response within a few hours or days following the root canal treatment [16]. The second factor responsible for endodontic failure is the foreign body reaction. Filling material extruded into the periapical area causes a foreign body type reaction in the connective tissue [17]. To be precise, the presence of microbial infection is the primary cause of endodontic failure, but foreign body reaction can aggravate and sustain the disease and its symptoms [18]. The mechanism of this reaction seems similar to the pathway of phagocytosis. Fine particles and exudates evoke a local tissue response, characterized by the presence of macrophages and multinucleated giant cells and the large pieces of the sealer are well encapsulated [19].

In case of penetration into maxillary sinus many authors believe that the extruded root canal filling material does not remain in one specific area of the antrum and acts as a foreign body. The ciliated mucosal cells tend to move it towards the natural orifice, which may then become occluded [20]. Therefore, in upper jaw root canal sealer extruded into the sinus can cause maxillary sinusitis, including aspergillosis infection, paranesthesia and as symptoms resembling neural complications [21]. Sometimes the smallest pieces may be transported by the cilia of the epithelium lining the maxillary sinus, contained in the mucus fluid against the forces of gravity, up to the nasal wall of the sinus, and out into the nose via the ostium. Small foreign bodies may be silently inhaled, especially during sleep. If inhaled in this way, there is a real danger of occurrence of pneumonia or lung abscesses [22]. On the other hand, components of endodontics sealers in maxillary sinus can cause blocking of ciliary movement because of the inflammation tissue reaction caused [23]. Such manifestations were not detected in our patient. Looking for optimal tissue reaction to endodontic materials, root canal sealers with varying formulas have been developed over time. Based on the analyses of the cytotoxicity of resin-, zinc oxide-, eugenol-, and calcium hydroxide-based root canal sealers on human periodontal ligament cells, Huang et al. [24] highlighted the importance of the biocompatibility of the filling material. Surveys have shown that all root canal sealers are neurotoxic to some degree and chemical neurotoxicity results from the constituents of the extruded materials [1,19]. Because calcium hydroxide (Ca(OH)2) sealers are commonly used as an interappointment dressing [8] Haanaes et al. [25] injected Ca(OH)2 into the maxillary sinus cavity of monkeys to evaluate its clinical, radiological and histological effect on the sinus mucosa. The authors ascribed the inflammatory response of the Schneiderian membrane to the material initially acting as a chemical irritant and later as a foreign body. Ca(OH)2 was irritating to tissue and had an immediate degenerative effect upon cells before the material was removed by macrophages or foreign body giant cells. Until such removal was complete, total repair with an absence of inflammation did not occur. The researchers also considered the amount deposited into the sinus as an important contributor to the inflammatory response. Results from this study clearly show that sinusitis can occur when Ca(OH)2 is delivered into the sinus [25].

Other experimental studies have shown that sealers containing both eugenol and paraformaldehyde, such as Endomethasone N, were the most toxic and could inhibit conduction of nerves action potential to varying degrees [26–28]. Paraformaldehyde is a potent neurotoxin and may cause chemical destruction of nerve axons because of its gaseous nature [29]. Brodin et al. [26] reported that Endomethasone can irreversibly inhibit the conduction of the action potential in the rat phrenic nerve. Serper et al. [28] found that the inhibitory effect of Endomethasone on isolated rat sciatic nerves is reversible but is more pronounced than the effect of non-eugenol calcium hydroxide root canal sealers. Radastina et al. [30] observed a strong positive connection between inhibition of the synthetic apparatus of fibroblast development under hydrocortisone effect, this way, it is possible to correlate the toxicity of Endomethasone to the presence of hydrocortisone. On the other hand, Orstavick and Mijör [31] observed a low toxicity to Endomethasone. Regarding the treatment of most commonly occurred symptoms that sealer extrusion can cause, the mostly recommended choice is surgical removal of the filling material from the anatomic structures, combined with apicoectomy, especially in cases of prolonged pain and swelling or pain and paranesthesia, when the sealer contains toxic additives and when radiographic evidence shows increasing periapical lesion. Russell et al. [32] and Kothari and Cannell [33] reported that when a sealer containing eugenol (Endomethasone N) and paraformaldehyde is extruded into the periodontal space, it should be removed as soon as possible.

However, in the literature there are case reports of root filling materials with non-surgical treatment too [4,8,9], such as the one of Gonzalez-Martin et al. [5] for example as well. The treatment followed in their report was just periodic follow-up visits. The particles of the sealer were phagocytosed by macrophages and

carried to the periphery of the inflammatory reaction [34]. In general, the resorption period may be dependent upon the amount of extruded material and/or individual variations in immunodefense reactions at the periapex [25,35].

The result, in the course of time, is that macrophages may completely clear the sealer from the periapical area, which then may eventually heal up [34], when the irritation or pain will subside. Such phenomenon is more likely to have taken place in the presented case as we believe, despite the previous histopathological and X-ray microanalyses of the subcutaneous tissue response to endodontic zinc oxide-eugenol-based materials, which appeared more resistant to fragmentation into small-sized particles for macrophage phagocytosis as observed with other sealers [31]. Therefore, we agree with the conclusion by various investigations, that the extrusion of sealer is not a complicating factor in the periapical healing and resorption of the extruded material is not a prerequisite for periapical healing, so resorption and healing must be considered separately [35,36]. Finally, a systematic review [37] reported that in the majority of the treated cases of root canal sealer extrusion, surgical treatment, or a combination of non-surgical and surgical had to be performed. Non-surgical treatment alone was performed in only 24% of the cases, but the full recovery rate of the reported non-surgically treated cases was higher (63%) than the recovery rate of the reported surgically treated cases (46%). So, regarding the treatment of symptoms that sealer extrusion can cause, the first choice, especially by absence of any patient's complains, is a wait-and-see approach, including anti-inflammatory drugs in case of moderate pain, together with periodic follow-up visits [4,5,7,9].

Conclusion

It could be easily understood that the main factor responsible for endodontic failures is not only the probable overextension of a sealer by itself, but rather the flare-up that can occur as a result of acute or exacerbated chronic peri radicular inflammation and apical extrusion of infected debris into the periapical tissues, during chemo-mechanical preparation. In cases of root canal sealer extrusion, surgical treatment should be recommended only if marked clinical symptoms are present or if there is radiographic evidence of an increasing periapical lesion.

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