

# Extrusion of Root Canal Sealer in Periapical Tissues - Report of Two Cases with Different Treatment Management and Literature Review

## SUMMARY

**Background:** 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 two cases of root canal sealer penetration into periapical tissues. A different treatment management was followed in each case. **Case reports:** A 55 year-old man underwent root canal retreatment of the right mandibular first molar tooth due to a periapical lesion. Postoperative periapical radiographs revealed the presence of root canal sealer (AH26) beyond the apex in the distal root in proximity to the mandibular canal. The patient reported pain for the next 7 days. Radiographic examination after 1 year showed complete healing of the periapical area and a small absorption of the root canal sealer. A 42 year-old woman was referred complained of swelling and pain in the area of the right maxillary first incisor. Radiographic examination showed extrusion of root canal sealer in the periapical area associated with a periapical lesion. Surgical intervention was decided upon, which included removal of the sealer, apicoectomy of the tooth and retrograde filling with MTA. After 1 year, complete healing of the area was observed. **Conclusion:** In conclusion, cases of root canal sealer extrusion, surgical treatment should be decided on only in association with clinical symptoms or with radiographic evidence of increasing periapical lesion.

**Key words:** Extrusion, Root Canal Sealer, Symptoms, Treatment Management

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## Introduction

Endodontic therapy is performed to clean the root canal system, alleviate pain and eliminate infection from the tooth. Ideally, the filling material should reach to the apex of the root, 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<sup>1</sup>. Although small material extrusions are generally well tolerated by the periradicular tissues, clinical symptoms such as pain, swelling of the lip, dysesthesia, paraesthesia,

hypoesthesia and anesthesia may appear, especially when the extruded filling materials are either close to, or in intimate contact with nerve structures<sup>2,3,4</sup>. There are generally considered to be four possible types of factors that can cause tissue damage and lead to the above symptoms:

- chemical factors because of the neurotoxic effects of the products used to clean or fill root canals,
- mechanical trauma from over-instrumentation (ex. perforation of mandibular canal),
- a pressure phenomenon from the presence of core filling material or sealer within the inferior alveolar canal, and
- overheating of tissues because of incorrect warm condensation techniques<sup>2,5,6</sup>.

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, the surgical elimination of the cause<sup>6</sup>. However, total resolution of pain and reduction or disappearance of paraesthesia after a non-surgical management have been reported<sup>3,4</sup>.

The aim of this paper is to describe two cases of endodontic sealer (AH26) penetration into periapical tissues and the treatment management followed in each case.

## Materials and Method

### Case report 1

A 55 year-old man was referred for root canal retreatment of the right mandibular first molar due to a periapical lesion (Figure 1). Root canal preparation was carried out by removing the old filling material, cleaning and shaping of the root canals. The canals were dried and filled with AH26 and gutta-percha. Postoperative periapical radiographs revealed the presence of root canal sealer (AH 26) beyond the apex in the distal root in proximity with the mandibular canal (Figure 1a). Although there were no complications during treatment, the patient reported pain for the next 7 days. Radiographic examination after 1 year showed complete healing of the periapical area and a small absorption of the root canal sealer (Figure 1b).



Figure 1

Figure 1a

Figure 1b

### Case report 2

A 42 year-old woman complained of swelling and pain in the area of the right maxillary first incisor. Radiographic examination showed extrusion of root canal sealer in the periapical area in association with a periapical lesion (Figure 2). Surgical intervention was decided upon, including the removal of the sealer, apicoectomy of the tooth and retrograde filling with MTA (Figure 2a). After 1 year, complete healing of the area was observed (Figure 2b).

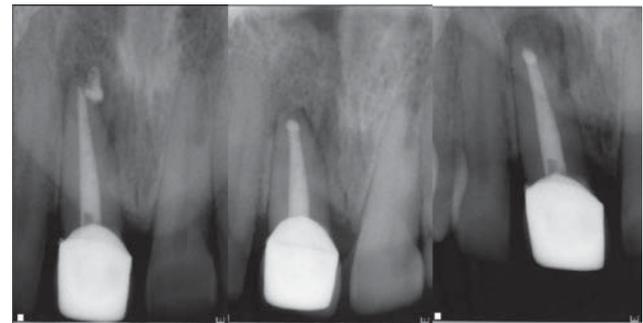


Figure 2

Figure 2a

Figure 2b

## Discussion

Many factors can increase the risk of sealer extrusion, for example, over-instrumentation, the complexity of the anatomy of the root canal system, excessive amount of sealer, excessive compaction force, hydrostatic pressure, the use of lentulo spirals, immature canal apices or root tip resorption<sup>7,8,9,10</sup>. Most of the case reports suggest that sealer extrusion, especially due to over-instrumentation, is more likely to happen in premolars and molars<sup>11</sup>.

In the maxilla, root canal sealer can be extruded into the sinus and cause maxillary sinusitis, including aspergillosis infection, paraesthesia and similar neural complications as symptoms<sup>12</sup>. 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<sup>13</sup>. Stasis of secretion leads to an anaerobic condition which favors the growth of *Aspergillus* spores. In most cases, *Aspergillus* infection is caused by root canal filling materials which contain zinc oxide-eugenol (ZOE) and paraformaldehyde that are accidentally introduced into the sinus. The results are reactions of inflammation and the blocking of ciliary movement<sup>14,15</sup>. Khongkhunthian and Reichart<sup>12</sup> reported a case of a 25-year-old woman who was sensitive to chewing and percussion on tooth #16 after root canal treatment several years previously. After radiographs had been taken, it was found that the root canal sealer of the tooth was extruded into the maxillary sinus, as well as the presence of a radiopaque mass near the opening to the nasal cavity. The diagnosis was aspergillosis of the maxillary sinus with apical periodontitis of #16 due to extrusion of the sealer. Treatment involved periapical surgery with retrograde filling of the buccal roots of tooth #16, antroscopy, and removal of the foreign body from the maxillary sinus.

In regard to the mandible, the main presenting symptoms are pain, swelling and paraesthesia. Post operative pain is thought to be associated with a

periapical inflammatory response and may persist from a few hours to many days after endodontic therapy<sup>16</sup>. Severe endodontic pain after sealer extrusion requires early diagnosis and immediate management to reduce the risk of permanent nerve damage<sup>17</sup>. The pain can be spontaneous, intermittent, or permanent. Eating, speaking, cold, or heat may trigger its onset. The patient may also complain of a burning sensation, a feeling of 'pins and needles', or pressure on the teeth<sup>18</sup>. Pain can be accompanied by local inflammatory signs with the tooth painful on percussion, painful upon palpation of the buccal alveolar process or a combination of signs of mechanical trauma and inferior dental nerve inflammation with pain or numbness of the lower lip<sup>19</sup>. Paraesthesia might be caused by over-instrumentation, by the pressure of endodontic materials in the mandibular canal after its perforation<sup>20,21</sup>, by neurotoxic effects, reversible and irreversible blockage of nerve conduction, or by alteration of the nerve membrane potential<sup>1,22</sup>.

An acute inflammatory response develops in the periradicular tissue as a result of additional insults from the root canal system, which can be of mechanical, chemical, or microbial origin. Mechanical and chemical injuries are usually associated with over-instrumentation, apical extrusion of irrigants or sealers etc<sup>16</sup>. Root canal sealers with varying formulas have been developed over time. Studies have shown that all root canal sealers are neurotoxic to some degree, and chemical neurotoxicity results from the constituents of the extruded materials<sup>23,1</sup>.

Experimental studies have shown that sealers which contain both eugenol and paraformaldehyde, such as Endomethasone and N2, were the most toxic and could inhibit conduction of the action potential of the nerves to varying degrees<sup>24,25,26</sup>. Paraformaldehyde is a potent neurotoxin and may cause chemical destruction of the nerve axon because of its gaseous nature<sup>27</sup>. Brodin et al.<sup>24</sup> reported that Endomethasone can irreversibly inhibit the conduction of the action potential in the rat phrenic nerve. Serper et al.<sup>26</sup> found that the inhibitory effect of Endomethasone on isolated rat sciatic nerves is reversible but is more pronounced than the effect of Sealapex or Calciobiotic root canal sealers.

Koseoglu et al.<sup>1</sup> reported the case of a 32-year-old woman with prolonged anesthesia in her right mandibular region following root canal treatment, performed 3 weeks earlier by her local dentist. Panoramic radiographs revealed the presence of root canal sealer (Endomethasone) in the mandibular canal. Decompression of the nerve by removing the sealer surgically was therefore decided upon. Another case report with Endomethasone extrusion is referred by Brkic et al.<sup>28</sup>. A 30-year-old woman had a sense of numbness in the region of right lower lip and chin, which had started 4 months earlier, one day after endodontic treatment of the mandibular right second premolar. A panoramic radiograph revealed the presence of radiopaque material,

extruded from the root canal on the lower right second premolar. Surgical removal of the extruded material was decided. Three weeks after the surgery, the patient reported recovery of sensation and 2 months later all symptoms had disappeared.

Regarding the sealers that contain eugenol, a case report with extrusion of ZOE-based sealer is referred to by Gambarini et al.<sup>29</sup>. A 59-year-old woman, after endodontic treatment on the mandibular left first premolar and second molar, presented paresthesia on the left posterior mandible, numbness on the left side of the lower lip and a tingling sensation in the buccal gingival. Both teeth had been treated with ZOE-based sealer and a panoramic radiograph showed radiopaque material beyond the apex of the mesial root of the mandibular left second molar and also beyond the apex of the mandibular left first premolar. The treatment was anti-inflammatory regimen for 4 weeks and periodic follow-up visits. Symptoms disappeared after 6 months. A similar case report was referred to by Froes et al.<sup>3</sup>, where a 42-year-old woman complained of acute and intense pain during the endodontic therapy. The root canal therapy (RCT) was halted and the patient was given potassium diclofenac, but the symptoms persisted. Computed tomograph revealed that the eugenol-based sealer had entered the mandibular canal. Treatment started with another anti-inflammatory regimen including naproxen and RCT continued. One week later, pain had disappeared, but the paresthesia persisted. At the end of the following 2 months, the paresthesia had completely disappeared. In contrast, Scolozzi et al.<sup>30</sup>, describe a case of pain and persistent anesthesia after RCT with PCS (pulpal canal sealer ZOE) due to the extrusion of this sealer, where symptoms had to be resolved with surgical treatment.

The sealer used in our cases was AH26. It is an epoxy resin - based root canal sealer which has recently become very popular due to its good physical properties. In the literature Scolozzi et al.<sup>30</sup>, report a case where AH26 along the mandibular canal caused pain and paresthesia after RCT. The use of antibiotics, NSAIDs and carbamazepine, didn't improved the symptoms, so sagittal osteotomy was decided on to remove the sealer and provide nerve decompression. After 6 months, the patient was symptoms free<sup>30</sup>. However, in the literature there are case reports of AH26 with non-surgical treatment too, such as that of Gonzalez-Martin et al.<sup>4</sup>. A 32-year-old woman underwent RCT in #37. A periapical radiograph revealed the presence of AH26 in the mandibular canal, with the patient reporting numbness, a tingling sensation and anesthesia. The treatment followed was periodic follow-up visits and 7 months later decreased paresthesia and anesthesia were observed. Nevertheless, AH26 has mild-to-moderate irritating effects when freshly prepared and this toxicity is due to the release of a small amount of formaldehyde or amines during the chemical setting process. These additives could be responsible for a

strong initial tissue response close to the sealer and for postoperative pain after extrusion of the sealer<sup>31,32</sup>. The toxic epoxide bisphenol resin contained in the sealer may also cause toxicity<sup>33</sup>. Taken together, these explain the propensity of AH26 to initiate periapical inflammatory reactions, if extruded into the periapical tissues. The chemical mediators of inflammation can cause pain by direct effects on sensory nerve fibers. The particles of the sealer are phagocytosed by macrophages and carried to the periphery of the inflammatory reaction. The result, in the course of time, is that macrophages may completely clear the sealer from the periapical area, which may then eventually heal<sup>34</sup>, when the irritation or pain will be subsided. Therefore, the conclusion supported by many investigations, is that, the extrusion of sealer is not a complicating factor in periapical healing and that resorption of extruded material is not a prerequisite for periapical healing, so resorption and healing must be considered separately<sup>35,36</sup>. Lin et al.<sup>37</sup> state that the extrusion of sealer is unlikely to be a factor in the failure of endodontic treatment and that canal filler is likely to cause less irritation to periradicular tissue than microbial factors. Huang et al.<sup>38</sup> concluded that the biocompatibility of the filling material is very important because biocompatibility stimulates the reorganization of damaged apical tissue remaining in direct contact with the material. Tanomaru et al.<sup>39</sup> have asserted that in teeth with chronic periradicular periodontitis, root canal sealers with antibacterial properties that do not irritate the apical or periradicular tissue may stimulate the deposition of mineralized tissue in the apical foramen, thereby assisting in healing. Leonardo et al.<sup>40</sup> have shown that periapical tissue reaction to AH Plus is excellent. Furthermore, the study found the apposition of mineralized tissue on the root canal walls in the apical area, and, in many instances, apical soft tissue that appeared to be in the process of becoming fully mineralized. In addition, it has been found histologically that AH26 material initially induced chronic periapical inflammatory reactions when extruded into the periapical tissues but after 6 months the material was phagocytosed by macrophages and carried to the periphery of the inflammatory reaction<sup>34</sup>. In general, the resorption period may be dependent upon the amount of extruded material and/or individual variations in immunodefense reactions at the periapex<sup>35</sup>.

Therefore, it could be easily understood that the main factor responsible for endodontic failures is not the probable extrusion of a sealer, but the flare-up that can occur as a result of acute periradicular inflammation and apical extrusion of infected debris into the periapical tissues during chemo-mechanical preparation. The frequency of flare-ups ranges from 1.4% to 16% and their intensity depends on the number and virulence of extruded microorganisms<sup>41,42</sup>. Forcing microorganisms and their products into the periradicular tissues can generate pain and swelling, as well as an inflammatory response within

a few hours or days following the root canal treatment<sup>43</sup>. It has been suggested that the presence of certain bacterial species is associated more with some clinical features of periradicular diseases, such as *Porphyromonas* species, *Prevotella* species, and *Finegoldia*<sup>44,45</sup>. Furthermore, Hashioka et al.<sup>46</sup> observed that in cases with pain on percussion, *Peptostreptococcus* species, *Eubacterium* species, *Porphyromonas endodontalis*, *P. gingivalis* and *Prevotella* species were found to be present. The second factor responsible for endodontic failure is foreign body reaction. Filling material extruded into the periapical area causes a foreign body type reaction in the connective tissue<sup>47</sup>. 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<sup>48</sup>. The mechanism of this reaction seems similar to the pathway of phagocytosis. The 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<sup>23</sup>.

Regarding the treatment of symptoms that sealer extrusion can cause, the first choice, in case of pain, is a wait-and-see approach, including anti-inflammatory drugs and periodic follow up<sup>49,3,4,50</sup>. According to some authors, the use of biocompatible materials did not suggest an immediate surgical approach, but rather a wait-and-see approach, since these materials usually undergo resorption overtime<sup>29</sup>. Surgical removal of the filling material from anatomic structures, combined with apicoectomy, is mostly recommended in cases of prolonged pain and swelling or pain and paraesthesia, when the sealer contains toxic additives, such as paraformaldehyde and when radiographic evidence shows increasing periapical lesion (Table 1). Russell et al.<sup>51</sup> and Kothari and Cannell<sup>52</sup> report that, when a sealer containing eugenol (Endomethasone) and paraformaldehyde is extruded into the mandibular canal, it should be removed from the mandibular canal as soon as possible because even a 4-day delay in the surgical removal of a nonresorbable phenol-based sealer could result in persistent paresthesia. In cases of paraesthesia, the medication used includes mostly corticosteroids, anti-inflammatory and vitamins complex. Two new combinations of medicines, also approved for peripheral neuropathy by the FDA and leading to a very rapid improvement in pain and paraesthesia, are duloxetine and pregabalin<sup>17</sup> and prednisone and pregabalin<sup>50</sup>. Alonso-Ezpeleta et al.<sup>17</sup> corroborate the above claim with a case report. A 36-year-old woman, one day post endodontic treatment, experienced severe pain in the treated tooth and numbness on the right side of the lower lip, due to AH Plus Jet extrusion. Non-surgical treatment was decided on which included prednisone, pregabalin and periodic follow-up visits. After six weeks, all symptoms had disappeared. A similar treatment, with the combination of prednisone and

pregabalin this time, has been also reported by Lopez-Lopez et al.<sup>50</sup>.

Finally, a systematic review<sup>53</sup> reported that, in the majority of the treated cases of altered sensation after extrusion of root canal sealer, surgical treatment or a combination of nonsurgical 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%). Regarding the obturation material, the majority of reported cases occurred in teeth obturated with paraformaldehyde-based sealers (39%), or resin-based sealers (29%). The full recovery of reported cases with resin sealers was significantly better (62%) than the paraformaldehyde cases, where it was only 27% .

Table 1. Case reports of sealer's extrusion

<i>Article details</i>	<i>Type of sealer</i>	<i>Clinical manifestations</i>	<i>Treatment</i>
Spielman et al <sup>18</sup> , 1981	AH26	Anesthesia, swelling	Surgical
Tamse et al <sup>19</sup> , 1982	1)AH26 2)AH26	Paresthesia Numbness	Non-surgical Non-surgical
Orstavik et al <sup>54</sup> , 1983	Endomethasone	Paresthesia, hypoesthesia	Non-surgical
Khongkuthian& Reichart <sup>12</sup> , 2001	Not specified	Sensitive to chewing- percussion, aspergillosis	Surgical
Yaltirik et al <sup>55</sup> , 2002	Endomethasone	Paresthesia, swelling	Tooth extraction-surgical
Yatsuhashi et al <sup>56</sup> , 2003	Paraformaldehyde	Numbness	Non-surgical
Scolozzi et al <sup>30</sup> , 2004	1)AH26 2)PCS(ZOE) 3)Home made paste 4) Not specified	Pain, paresthesia Pain,paresthesia, hypoesthesia Pain, numbness, paresthesia Pain	Surgical Surgical Surgical Surgical
Lambrianides& Economides <sup>57</sup> , 2005	Not specified	Pain, hypoesthesia	Non-surgical
Koseoglu et al <sup>1</sup> , 2006	Endomethasone	Numbness, anesthesia	Tooth extraction-surgical
Poveda et al <sup>49</sup> , 2006	Endomethasone	Numbness, tingling sensation	Non-surgical
Pogrel <sup>6</sup> , 2007	Not specified	Pain, paresthesia	Surgical, non-surgical
Scarano et al <sup>58</sup> , 2007	ZOE	Pain, numbness, anesthesia	Non-surgical
Escoda-Francoli et al <sup>59</sup> , 2007	Not specified	Pain, paresthesia	Tooth extraction, surgical, non-surgical
Batur & Ersev <sup>60</sup> , 2008	Endomethasone	No symptoms	Non-surgical
Froes et al <sup>3</sup> , 2009	Eugenol-based	Paresthesia, pain	Non-surgical
Brkic et al <sup>28</sup> , 2009	Endomethasone	Numbness	Surgical
Gonzalez-Martin et al <sup>4</sup> 2010	AH26	Numbness, tingling sensation, anesthesia	Non-surgical
Gambarini et al <sup>29</sup> , 2011	ZOE	Paresthesia, numbness, tingling sensation	Non-surgical
Lopez-Lopez et al <sup>50</sup> , 2012	AH Plus	Pain, numbness,tingling sensation, anesthesia	Non-surgical
Alonso-Ezpeleta et al <sup>17</sup> , 2014	AH Plus Jet	Pain, numbness, paresthesia	Tooth extraction, non-surgical
Coskunses et al <sup>61</sup> , 2016	Forfenan (paraformaldehyde)	Anesthesia, numbness, swelling	Surgical

## Conclusions

In cases of root canal sealer extrusion, surgical treatment should be recommended only if clinical symptoms are present or if there is radiographic evidence of an increasing periapical lesion.

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