CASE REPORT

Accidental overextension of endodontic filling material in patients with neurologic complications: a retrospective case series

Jo-Eun Kim, Jun-Bum Cho, Won-Jin Yi, Min-Suk Heo, Sam-Sun Lee, Soon-Chul Choi and Kyung-Hoe Huh

Department of Oral and Maxillofacial Radiology and Dental Research Institute, School of Dentistry, Seoul National University, Seoul, Republic of Korea

Accidental overextension of filling material during endodontic treatment may cause mechanical and chemical irritation of the adjacent tissue. In this case series, seven patients who complained of neurologic complication after overextension of canal filling material during endodontic treatment were presented. Overextensions of filling material into the surrounding tissues, such as the mandibular canal, bone marrow, and submucosal layer, were confirmed with panoramic radiograph and computed tomographic images. When patients complain of neurological disturbances after root canal treatment, proper radiographic images should be taken to verify any overextension of materials and to determine the specific location of the overfilled materials.

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Introduction

It is well established that endodontic materials should be limited to root canals without extension into peri-apical tissues during root canal treatment. However, overextension of these materials may take place accidentally through overinstrumentation or perforation of the root canals, allowing passage of dressing agents, sealers, or filling material to neighbouring structures. Careful attention is needed in such cases of overextension because the patient may experience complications such as pain or tissue necrosis.¹⁻⁴ The complications may be even more severe when the overextended material reaches the mandibular canal, resulting in neurologic complications such as anaesthesia, paraesthesia, hypoesthesia, hyperaesthesia, or dysaesthesia.^{1,5-8}

This article presents seven clinical cases of iatrogenic complications of endodontically treated teeth resulting

from overextension of canal filling material into the surrounding tissues including the mandibular canals and bone marrow. Subsequent damage and treatment methods are also presented.

Case reports

Information about all seven cases of overextension of canal filling material is shown in [Table 1](#). All patients had symptoms of paraesthesia, numbness, or pain related to the root canal treatment. Overextensions of filling material into the surrounding tissues, such as the mandibular canal, bone marrow, and submucosal layer, were confirmed with panoramic radiograph and computed tomographic images. Five cases (Case 1–5) were related to endodontic treatment of mandibular molars or premolars ([Figures 1–3](#)), and all of them underwent surgical removal of the overextended endodontic filling material. Four of the five patients showed moderate to substantial improvement in sensation of the lower lip

Correspondence to: Kyung-Hoe Huh. E-mail: future3@snu.ac.kr

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Table 1 Summary of cases complaining of neurologic symptoms due to overextension of endodontic filling material

Case number	Age	Sex	Treated teeth, location	Overextension material	Symptoms	Treatment	Time between overextension and removal (months)	Follow-up evaluation
1	44	F	#37, Mandibular canal	Calcipect ®	Paraesthesia of her left lower lip and chin	Surgical removal and nerve graft	3.3	10 months, nerve mapping results confirmed improvement of sensation
2	56	F	#37, Mandibular canal	Vitapex ®	Paraesthesia and pain on her lower lip and chin area	Surgical removal	2.2	15 months, residual paraesthesia and pain restricted to a very small area of her lower lip
3	24	F	#46, Mandibular canal	Calcipect	Numbness and paraesthesia of her right lower lip and chin	Surgical removal	5	2 years, substantial improvement in sensation and paraesthesia
4	31	F	#47, Mandibular canal	Calcipect	Numbness of her right lower lip and chin	Medication (methylcobalamin)		No improvement
5	47	F	#34, 35, bone marrow	Vitapex	Numbness of her left chin and lip, and tooth pain.	Surgical removal	0.8	14 months, residual pain of the lower left incisors with full recovery of her sensation on the lip and chin
6	51	F	#14, Bone marrow	Gutta percha with sealer	Pain	Removal of grafted bone (#16, 17 area)		1 month, no improvement
7	26	F	#14 Palatal mucosa	Temporary filling material	Pain and paraesthesia	Dressing		3 weeks, healing of palatal mucosa with residual pain

F, female.

and chin during the follow-up period. The other two patients (Case 6 and 7) presented an overextension of endodontic filling material into the bone marrow of the maxilla and the submucosal layer of the palate, respectively (Figures 4 and 5). Those unusual two cases involving the maxillary structure are presented below, in detail.

Case 6

A 51-year-old female patient was referred from her general dental practitioner. The patient's chief complaint

was persistent pain in the right maxillary area after implant surgery, which had taken place one and a half years prior. She had been taking medication about a year to control the pain, which was suspicious for trigeminal neuralgia. However, the diagnosis was not confirmed and she did not notify any improvement of symptoms. Periapical radiograph revealed implant fixtures on the right upper second premolar and the first molar areas. Bone graft material was observed around the implant fixture on the first molar area, and no sign

Figure 1 (a) A cropped panoramic image of Case 1. (b) Coronal CT image of Case 1. Black arrowheads indicate the high attenuated filling material that spilled into the mandibular canal and bone marrow. Mandibular canals of both sides are marked with black arrows. (c) Cropped panoramic image of post-operative state.

Figure 2 Images of Case 3. (a) The panoramic radiograph demonstrates the overextended canal filling material along the mandibular canal *via* distal root of right first molar. (b) Axial CT image of Case 3. Overextended filling material (black arrowheads) is shown along the lingual side of the mandibular canal (white arrows). (c) Cropped panoramic image of post-operative state.

of any pathologic lesion was found around the fixtures (Figure 4a). However, some type of radio-opaque material was observed right above the first premolar. CT images were taken to evaluate this radio-opaque material. Different attenuation was noted between the bone graft material around the implant fixture and the material just above the endodontically treated first premolar (Figure 4b). It was assumed that the material in the first premolar area was not a type of bone graft material but rather some type of root canal filling material that had been overextended from the tooth. However, the patient stated that the discomfort had increased immediately after the implant surgery, which had taken place before the root canal treatment. Therefore, the treatment plan included removal of the bone graft material and observation. At 1-month post-operative follow-up visit, the patient reported persistent discomfort but refused further treatment.

Case 7

A 26-year-old female patient presented to our hospital complaining of pain and paraesthesia on the right side of her palate. Clinical examination revealed mucosal necrosis. She had previously received root canal treatment for the right upper first premolar at a local dental

practice. Panoramic and periapical radiographs revealed overextension of radio-opaque material above the upper right premolars and molars, and perforation of the right upper premolar on the distal side was suspected (Figure 5a). CT images were taken to verify the exact location of the overextended material, and it was found that the material had spread along the palatal submucosal layer anteriorly to the canine area and posteriorly just below the greater palatine foramen (Figure 5b). It was clear that the material had not infiltrated the bony tissue. A diagnosis of soft-tissue foreign body of the right palate was reached, and the treatment plan was to perform dressing and observation. Clinical evaluation after 20 days confirmed mucosal healing, so the patient was referred to the Department of Conservative Dentistry for perforation repair.

Discussion

The present case series demonstrates overextension of filling material used during root canal treatment and that caused subsequent damage to surrounding tissues,

Figure 3 (a) A cropped panoramic radiograph of Case 5. Excessive radio-opaque canal filling material was extended to the mandibular inferior cortex. (b) A periapical radiograph of Case 5. (c) A cropped panoramic image of post-operative state demonstrates no residual material.

Figure 4 (a) A panoramic radiograph of Case 6. (b) Axial CT image of Case 6 demonstrates the overextension of canal filling material into the bone marrow around the apex of right upper first premolar (black arrowheads). The attenuation of endodontic filling material is higher than that of graft bone (white arrowheads).

which resulted in pain and neurologic symptoms. Although many reports have been published on injury to peripheral nerves after endodontic treatment, most cases involve damage to the inferior alveolar nerve (IAN). The cases introduced in the present article demonstrate unusual sites of overextension including bone marrow of the maxilla and the palatal submucosal layer as well as the mandibular canal.

Complications following overextension of endodontic filling material could arise *via* mechanical and/or chemical mechanisms. The adjacent tissues, including nerve, can be directly damaged by overinstrumentation mechanically during root canal preparation and by overextension of filling material chemically. When determining the cause or mode of traumatic injury during endodontic treatment, the anatomy of the periapical region should be considered. According to Littner and colleagues,⁹ the upper border of the mandibular canal is located 3.5–5.4 mm below the root apices of the first and second molars. However, the anatomy of the IAN is more complicated than previously thought, and the relationship between the IAN and the molar root apices varies.^{10,11} These structures are sometimes very close, and in some patients, there is direct contact between the

apices of the molar teeth and the mandibular canal,¹¹ which increases the risk of extension of endodontic materials and subsequent chemical and mechanical nerve injury. Therefore, careful radiographic diagnosis is necessary because the nerves or blood vessels can be damaged directly when the mandibular canal and the root apices are in close proximity. An initial radiograph taken with the files in position will not only ensure the correct working length but also prevent perforation of the canal and possible subsequent damage to the inferior alveolar nerve resulting from endodontic treatment.

One of the important contributing factors that cause overextension is the characteristic of the canal filling material. In the present case series, most of the materials used were injectable calcium hydroxide [Calcipex® (Nippon Shika Yakuhin Co. Ltd, Yamaguchi, Japan), Vitapex® (Neo Dental Chemical Products, Tokyo, Japan), and Metapaste® (Meta Biomed Co., Cheongju, Korea)]. These pastes had high flow characteristics. In addition, extreme pressure during injection of filling material could help extend large volumes of material to apical and neighbouring tissues. Another contributing factor of tissue damage

Figure 5 Case 7: (a) a panoramic radiograph shows the overextension of radio-opaque filling material *via* apex of right upper first premolar. (b) Axial CT image demonstrates the high attenuated filling material (white arrowheads) along the palatal mucosa.

that can occur is with improper preparation of the root canal and excessive widening of the apical foramen, with disappearance of constriction.¹² This is often responsible for the passage of materials beyond the apex and can cause tissue damage by chemical, mechanical, or infectious means.

When patients complain of pain or neurological discomfort during or after endodontic treatment, panoramic radiograph and CT images should be taken immediately for thorough examination and exact diagnosis. Radiological data will help clinicians verify whether the material has infiltrated the mandibular canal, maxillary sinus, or just the neighbouring bone marrow.

In Case 7, overextension of endodontic filling material to the maxillary sinus wall was suspected on plain radiographs. When CT images were taken for the exact localization of the foreign body, it was revealed that the material was limited to the palatal submucosal layer, without infiltration into bone marrow or maxillary sinus. Also, in Case 6, CT images were useful for distinguishing endodontic filling material from the graft material used during previous implant surgery. The difference between the two materials in attenuation on CT images made it possible to easily identify the endodontic filling material. However, removal of the bone graft material was performed based on the patient's report that discomfort had increased right after the implant surgery. We think that in this case, the endodontic filling material was the cause of the pain, given that the patient complained of discomfort even after the removal of the bone graft material.

Diagnosis of complications due to accidental overextension of endodontic filling material requires an accurate patient history to determine the onset of sensory alteration and its evolution. Examination of the affected area can be carried out using thermal, mechanical, electrical, or chemical tests that elicit subjective responses.¹³ When complications are suspected from the patient's complaints, history, and clinical examinations, overextension of filling material should be confirmed *via* radiography. CT is a useful imaging modality because it can not only demonstrate the presence of overextension of filling material but also its exact location and amount. Limited volume, high resolution CBCT is recommended in the step of treatment planning for cases with potential complicating factors such as the proximity of important anatomical structures. CBCT may be considered as a modality of choice for

evaluating neurologic complications. However, CBCT cannot provide appropriate information about soft-tissue change. We recommend that multislice CT, rather than CBCT, be used when neurologic complication associated with endodontic treatment is in doubt because the extent of tissue damage including soft tissue and bone marrow should be evaluated. As statements from SEDENTEXCT 2012, where it is likely that evaluation of soft tissues will be required as part of the patient's radiological assessment, the appropriate initial imaging should be multislice CT or MR, rather than CBCT.¹⁴

Though treatment of endodontic complication remains controversial,² many reports have shown that the surgical removal of material from the mandibular canal is an effective treatment for paraesthesia and anaesthesia cases attributable to the extrusion of endodontic materials capable of completely resolving these symptoms.^{1,3-5} Although improvement in symptoms was shown in all of the patients, the patients in the present case series did not show complete or dramatic restoration of normal sensation. There seems to be a correlation between duration, origin, and significance of the injury and prognosis of paraesthesia.^{1,5,15} The technique and type of filling materials also seem to be related to the prognosis and further studies are needed to investigate the relationship. It is widely accepted that the longer the mechanical or chemical irritation persists, the greater the risk that the paraesthesia will become permanent.¹¹ Though the prognosis of surgical treatment is comparably good, full recovery of nerve damage is not always attainable. Therefore, it is important to remember that complications are always possible, and clinicians should always be careful during endodontic treatment.

In conclusion, when patients complain of neurological disturbances after root canal treatment, radiographic images, including panoramic radiograph and CT images, should be taken to verify any overextension of materials and to determine the specific location of the overfilled materials.

Consent

Written informed consent for the case to be published (including images, case history and data) was obtained from the patients for publication of this case report, including accompanying images.

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