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Surgical Treatment of Odontogenic Injuries of the Inferior Alveolar Nerve after Endodontic Surgery.

Sergey Vladimirovich Sirak*, Armenak Valerievich Arutyunov, Evgeny Vyacheslavovich Schetinin, Alla Grigorievna Sirak, Irina Anatolievna Kopylova, and Ruzanna Arturovna Avanesyan.

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ABSTRACT

This paper deals with the issues of surgical treatment of odontogenic injuries of the inferior alveolar nerve after endodontic surgery. Surgery involved the removal of the dental filling material from the mandibular canal. Operations were carried out in 89 patients of 92 examined; other 3 of them have refused surgery. There has been found that the treatment of patients with acute compression-toxic neuropathy of the inferior alveolar nerve as a severe complication shall be started as earlier as possible with the most intensive care, treating this disease as the medical emergency.

Keywords: trauma, inferior alveolar nerve, endodontic surgery, mandible, mandibular canal

Corresponding author

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INTRODUCTION

Problem of prevention and treatment of complications arising from the root canal filling with different materials, remains relevant [4-7, 17, 18, 20]. Odontogenic compression injury of the inferior alveolar nerve (IAN) is one of the most serious complications due to excretion of the filling material in the mandibular canal [1, 5, 6, 11, 12, 21], in addition, an "active retroapical therapy" is accompanied by multiple root sealant excretion outside the root canal.

Figure1. Ortopantomogramma of patient S., 16 years old

The reasons for this complication were sufficiently studied in a number of scientific papers in recent years [4-6, 8-10, 17, 20]. Some authors distinguish anatomical and topographical backgrounds to the emergence of this complication, however, the underlying causes are medical errors, such as lack of radiological monitoring during the treatment, work without apex locator, the use of the "one-paste" or "one pin" methods or machine root fillers in treating the secondary teeth with incomplete formation of the root tip (Fig. 1, 2).

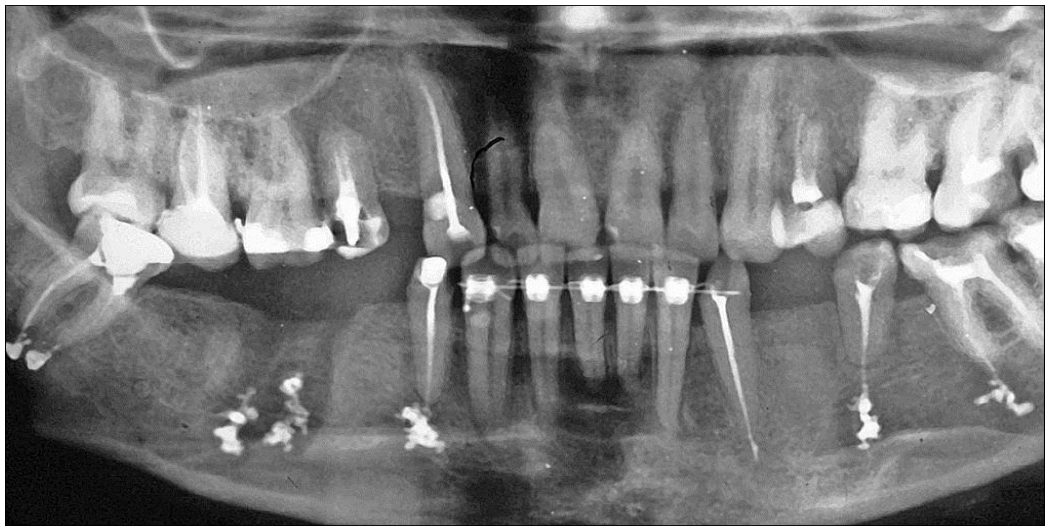

Figure 2: Ortopantomogramma of patient K., 39 years old

Mechanism of injury of the neurovascular bundle of the mandible has not been studied comprehensively [2, 7, 8, 11]. What is known is that the emerging phenomenon of nerve compression together with chemical and toxic effects of the filling material [12], derived in the cavity of the canal, creates the characteristic clinic of resistant hypo- and paresthesia in the peripheral regions of the inferior alveolar nerve [6, 11, 12, 14 , 16, 21]. Some of authors have found that the increase in the skin electroexcitability threshold of the corresponding face zones up to 100 mkA and decrease in electroexcitability of the pulp of adjacent teeth up to 30-40 mkA during injection of filling material into the mandibular canal (MC), even without evident pain, indicates compression injury and peripheral circulation disturbance in the lower basin of the alveolar artery.

Numerous studies have studied both undesirable consequences of medical procedures in endodontic treatment, and toxicity of filling materials used, leading to serious complications that can occur painlessly (granuloma and cyst formation) or with the various manifestations of iatrogenic neuropathies of III branch of the trigeminal nerve in the form of paresthesia and facial pain [4, 6, 12, 18, 19, 21]. Such drastic consequences of errors of endodontic treatment, when neurovascular bundle, located in the mandibular canal, is damaged, require early treatment aimed at the elimination of the reason and correction of pathogenetic mechanisms of complications developed.

Thus, damage to the mandibular nerve and its branches by filling material, expressed in hypo-and paresthesia of relevant areas of skin, in pain of different strength and duration, as well as possible development of inflammatory processes in the surrounding tissues [4, 8, 16] requires surgical removal of the root sealant [3, 6, 11]. In this regard, early diagnosis and surgical treatment of this complication, causing great suffering to patients, is a socially significant and relevant method to improve dental care.

Technique

Clinical observations were performed in 92 patients aged 16 to 67 years, 89 of them were women and 3 - men. All the patients had a filling material found, which was delivered into mandibular canal. Treatment. After making local anesthesia, a cut was made from the retromolar area to canine where a vertical relief incision was performed. Mucoperiosteal flap was thrown back to the lower border of the mandible and the osteotomy was performed in the form of elongated rectangular window in the middle or lower third of the jaw, 5 mm distal of the mental foramen. Saw cut of the cortical bone of the mandible was performed using a Straight-saw and Piezosurgical apparatus accompanied with abundant irrigation of the operating area with saline (Fig. 3).

An autoplastic graft obtained was placed in a saline, and, after removing the filling material, it was stacked without additional fixation, covered with mucoperiosteal flap and sutured (Fig. 4). Completeness of material removal by suspected injury of perineural tissue was monitored radiographically, including by digital analog radiography and radiovisiography. Intraoperative monitoring was carried out using the Viking Quest (USA) apparatus, which provides the necessary opportunities for neurophysiologic monitoring during surgical interventions.

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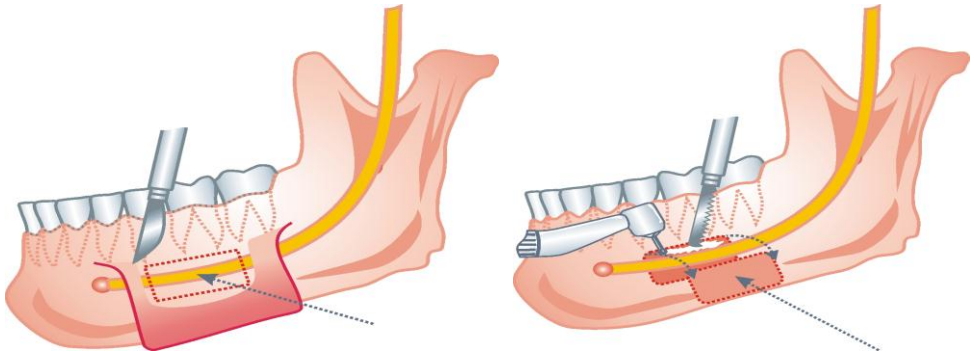

Figure 3: Detachment of muco-periosteal flap with vertical relief incision in the canine area. Marking of the bone window. On the right side - sawing of cortical bone of the jaw using a Straight-saw

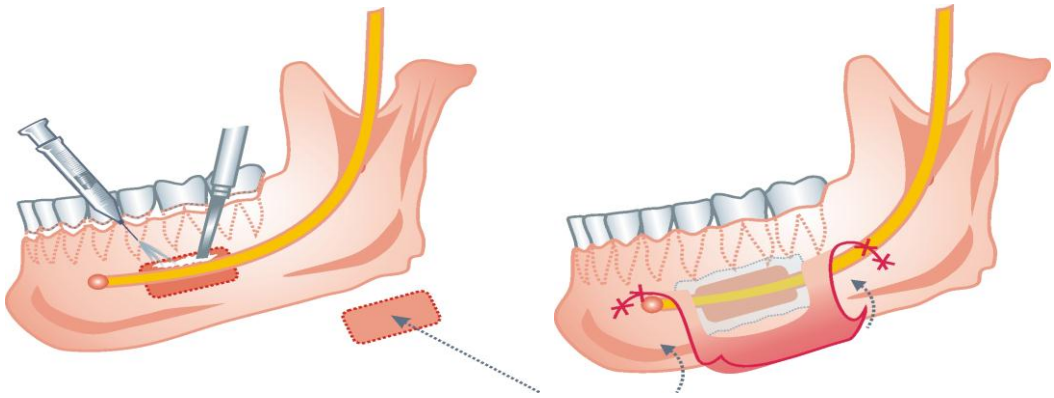

Figure 4: Removal of filling material with constant irrigation surgical of the operative wound with an antiseptic solution, on the left side - reposition of the cortical bone fragment, the imposition of bioresorbable membrane. On the right side - wound closure with a mucoperiosteal flap.

Complex of postoperative therapy included phonophoresis with hydrocortisone, amplipulse phoresis with 2% solution of nicotinic acid, vitamin therapy with vitamin B12, B1. In addition, all patients were prescribed a mud therapy in 2 weeks after surgery to recover the peripheral circulation, and the sensitivity of soft tissues - external application of Tambukan mud to the mandibular region in the insulating sterile napkins with two electrodes (10-12 mkA) for 15 minutes #20. General tonic therapy included a general balneotherapy such as hydromassage, conifer-pearl and sulfide baths of 10 procedures. Acupuncture with 13 mm needles was prescribed in the local and regional points (point 3, the third square in the middle of the upper horizontal line drawn through the ear lobe on the side affected), two courses of 15 sessions with an interval of 7 days.

To normalize the blood flow and eliminate tissue hypoxia in patients having the filling material in the mandibular canal for a long time (9 months to 1.5 years) the course of the local (intraoral) hyperbaric oxygenation was carried out after surgical removal of the root sealant from MC and the comprehensive treatment [8].

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Main Body

According to our observations, the removal of the filling material, regardless of its amount, should be carried out as soon as possible to eliminate both compression, and the toxic effect of the filling material on the tissues of the neurovascular bundle. Nature of the developing pain syndrome depends on the duration while filling material stays in MC. In short periods (up to 1 month), patients draw attention to the sensory perception of pain (assessment of acute or dull pain and emotional-affective pain assessment), while in long periods (from 6 months) the attention is drawn to frequency and duration of pain attacks. Indication for surgical treatment of patients with filling material delivered to the mandibular canal is the presence of pain, numbness of the lower lip and the X-ray determination of the foreign body. Contraindication to the use of the surgical treatment method developed was considered the general condition of the patient, which is a contraindication for any surgery in the maxillofacial area.

Comparative analysis of several methods of surgical access to the mandibular canal to evacuate the filling material, based on the data of its anatomical and topographical features, has shown the following.

The first method was proposed by G.I. Sabalis and V.A. Karlov (1982) for decompression of the inferior alveolar nerve in case of neuralgia. The method proposed by the authors involved making the cut at the mucobuccal fold and peeling a mucoperiosteal flap under local anesthesia. In place of the projection of the lower jaw channel behind the place where the filling material was determined radiographically, a hole of about 10 mm in diameter was drilled with a spherical milling cutter on the side surface of the mandible body and thus its canal was opened. Horizontal bone saw cut was performed with the device (Figure 5 - a), presenting a working dental handpiece with cutter of 2-3 mm in diameter, with a L-shaped rod of 2 mm in thickness attached to it. Cutter and the rod are introduced into the hole made in the lower jaw, while the horizontal part presses the neurovascular bundle to the opposite wall of the canal. A dental drilling machine is switched on, and the lateral wall of the canal is removed by moving a drill tip in the direction of the jaw channel, i.e. a cut 2-3 cm long is made (Fig. 5 - b).

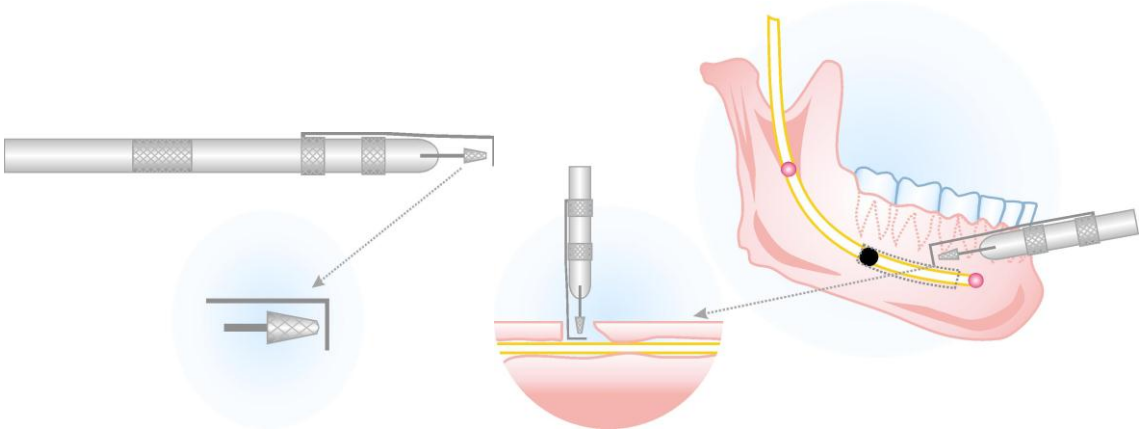

Figure 5: a) left - a device for perforating the wall of the mandibular canal (G.I. Sabalis, V.A. Karlov, 1982); b) right - a horizontal sawing of the outer cortical bone and the mandibular canal wall

The horizontal part of the rod, moving along the mandibular canal, isolates the neurovascular bundle from the cutter and protects it from possible damage. The resulting saw cut has a width of 3-4 mm and a length of 2-3 cm. After radiographic control having confirmed the absence of a foreign body in the canal, the bone defect is closed with bioresorbable membrane and a muco-periosteal flap is laid in place and fixed with seams.

Advantages of this method: reduction of the risk of damage of infero-alveolar neurovascular bundle, reduction of access time to the mandibular canal, removal of only that part of the lower jaw compact disc, which is directly adjacent to the wall of the mandibular canal.

Disadvantages: the authors originally suggested an extraoral access to the body of the mandible. The width of the resulting saw cut does not allow removing all of the filling material from the mandibular canal and cancellous bone. The technique does not involve possible existence of additional mandibular canal.

The second method was described in the literature by L.A. Grigoryants (2002) for the removal of the filling material from the mandibular canal (Fig. 6-a) with prompt access to gingival margin.

The surgical method proposed is as follows: after the appropriate regional anesthesia a mucoperiosteal flap was dissected along the gingival margin. After raising it, the trepanation of cortical bone was performed above the projection of tops of the roots of the causative teeth. Bone was removed by drilling machine towards the mandibular canal with opening its wall. Further, an oval window was formed for better access to the neurovascular bundle. Thereafter, the filling material was removed by periodically washing the wound with saline via a syringe. Then, the wound was closed with bioresorbable membrane and sutured with interrupted sutures.

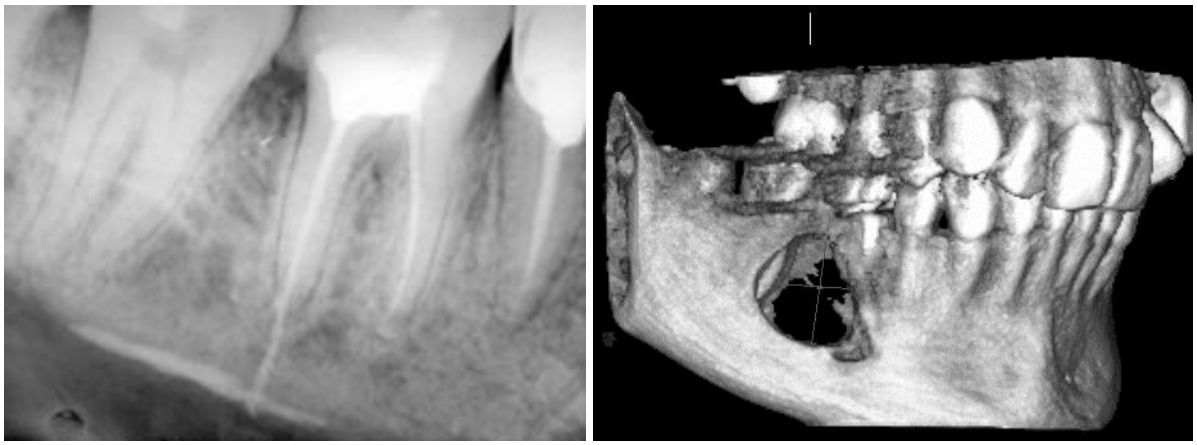

Figure 6: Patient A. a) left - radiogram before surgery, filling material, delivered in the mandibular canal in endodontic treatment of 46 tooth; b) right - CT scan, postoperative defect

Advantages of this method: reduction of the risk of damage of inferior alveolar neurovascular bundle. It gives an extensible cut-down access to the mandibular canal, the surrounding bone tissue, tops of the teeth roots for retrograde filling, if necessary.

Disadvantages: this technique does not involve obtaining a graft to close postoperative defect (Fig. 6-b). When accessing the periodontal margin the risk of gingival recession increases in the posterior region of the mandible in the postoperative period.

The third osteotomy method is widely used in the implantology, in particular, S. Solar et al, K. Babbush, S.Yu. Ivanov et al. suggest it for lateralizing the inferior alveolar nerve during the installation of dental implants. We have modified this access method to remove the dental filling material from the mandibular canal.

Before the surgery, a detailed survey X-ray examination was performed to determine the precise location of the filling material in the mandibular canal. After the regional and infiltration anesthesia with sol. Ultracaini 4% solution with adrenaline 1:100,000, a trapezoidal cut was made starting in retromolar region to the medial part of the canine, where a vertical relief incision was made. An entire mucoperiosteal flap was peeled with the use of a raspatory. Course of the mandibular canal was marked with a sterile pencil on the exposed cortical jaw plate, 0.5-0.7 cm below the junction of the alveolar part with the base of mandible. Using ultrasonic device "Piezosurgery", osteotomy was performed in a rectangular window in the middle third of the mandible in the boundaries marked. The bone was sawed at 45º, with constant cooling with sterile saline. 45º angle allowed making further reposition of the bone fragment without additional fixation. Then, the residual bony partitions were separated.

An autogenous bone was cracked and separated as a fragment of a rectangular cortical bone 1x1.5 cm. The resulting graft was placed in saline (Fig. 7). All the filling material was removed from the mandibular canal and cancellous bone of the jaw, the defect was closed with an autogenic graft and mucoperiosteal flap sutured with interrupted sutures. Sutures were removed on the 7th day.

Advantages of this technique are the provision of an extensible cut-down access to the mandibular canal, the neurovascular bundle and the surrounding cancellous bone, which allows removing all the filling material. An autogenic graft obtained after cutting is used to close the bone defect. Visual control while removing the layer of spongy bone and mandibular canal wall helps to avoid damage to blood vessels and the inferior alveolar nerve.

The modified technique, in our opinion, is most preferrable variant, especially in molar zone, where the thickness of the outer cortical bone of the mandible is increased due to the external oblique line. In addition, considering close adjacency of the mandibular canal to the lingual cortical plate in the zone of the second and the first molar, surgical sawing of the bone block in this jaw area is quite safe.

The statistics of complications studied is of exceptional interest - there is only 3 male persons of 92 patients having this pathology. We have found the same "discrimination" on grounds of sex in the literature available. The reasons for this separation, in our opinion,

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cannot be caused only by social and anatomical reasons (however, we accept this factor to be the major one), and they require further study.

Figure 7: Scheme of the operation in removing filling material from the mandibular canal in the main patient group (author's technique)

CONCLUSION

Thus, the operation for removal of the filling material from the mandibular canal with an extensible cut-down access to the vestibular surface of the mandible using a graft for closing the defect is fast, technically simple, and allows removing all the filling material, avoiding complications in the postoperative period and shortening the period of recovery of the functions of the lower alveolar nerve.

SUMMARY

- Treatment of patients with acute compression-toxic neuropathy of the inferior alveolar nerve as a severe complication, caused by wrong delivery of the filling material in the mandibular canal, shall be started as earlier as possible with the most intensive care, treating this disease as the medical emergency.

- Method of cut-down access to MC developed has advantages over the access to gingival margin and horizontal cutting method, due to the ability to remove all the filling material, obtain graft for closing the defect of the cortical bone of the jaw, and prevent gum recession in the postoperative period.

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