IEJ
Iranian Endodontic Journal

Mental Nerve Paresthesia, a Complication of Anesthesia in Non-surgical Endodontic Treatment: A Case Report

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Article Type: **Case Report**

Received: 15 Nov 2024
Accepted: 11 Dec 2024
Published: 01 Jan 2025
Doi: *10.22037/iej.v20i1.45478*

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Paresthesia is described as a burning or prickling sensation or partial numbness caused by neurologic injury. The sensory loss may be the result of a reversible and/or irreversible nerve damage, and it can be caused by local or systemic factors. Local factors include traumatic injuries caused by impacted teeth, local injection, endodontic therapy, implant placement and exposure to toxic materials. This article reports a paresthesia by anesthetic injection. A 44-year-old man reported moderate pain during chewing and exposure to cold. Upon clinical examination, extension of the tooth fracture line was in the mesiodistal region of the mandibular left second premolar crown and was detected with 16× magnification of microscope. The diagnosis was cracked tooth syndrome, and root canal treatment was indicated. After the first appointment the patient reported altered sensation on left side of mandible, numbness and electric shock sensation, and therefore was diagnosed with mental nerve paresthesia. Diclofenac sodium, thiamine, cyanocobalamin, and pyridoxine were prescribed for 7 days as part of the treatment, and then root canal and restorative treatments were completed. Patient was scheduled for follow-up appointments after 1, 3, 6, and 8 months. After the first month, the feeling of paresthesia was still present and the patient was experiencing a painful "electric shock". At the 8-month follow-up visit, the paresthesia had been resolved with return of normal sensation.

Keywords: Endodontics; Local Anesthesia; Mental Nerve; Non-surgical Treatment; Paresthesia; Anesthetic Injection

Introduction

Paresthesia is a neurosensory alteration resulting from a type of nerve injury and is commonly described by patients as a sense of warmth, cold, burning, aching, prickling, tingling, numbness, or itching in the absence of stimuli [1]. Paresthesia may occur due to several reversible and irreversible conditions affecting the peripheral nervous system [2]. There are different factors associated to paresthesia; local anesthetics, traumatisms, local infections, neoplasms, complications related to root canal treatment, third molar surgery, orthognathic surgery and implants are among the local factors [3]. Among the systemic factors, there are microbial infections, multiple sclerosis, lymphoma, and diabetes mellitus [4, 5].

The mental foramen is an anatomic structure located in the lateral surface of the mandible. It represents the termination of the mandibular canal which opens into the surface in an oblique direction and supplies sensory innervation and nutrition to the soft tissues of the chin, lower lip, and gingiva [6, 7]. The close anatomic proximity between the root of the mandibular premolars and the mental nerve foramina must be carefully assessed [5, 8]. The mantal foramen is located between the apex of mandibular premolar teeth in 63 to 70% of the cases [9]; Aquilanti *et al.* [6] reported that in 62.7% of cases, it is located under the apex of the second premolar tooth. This represents a position that is slightly mesial to the radiographic apex of the second premolar tooth due to the normal distal root curvature of this tooth [6, 9]. Currently, cone-beam computed tomography (CBCT) scans can show the structures close to the anatomic landmarks in three dimensions, allowing a more reliable assessment regarding their locations [9-11].

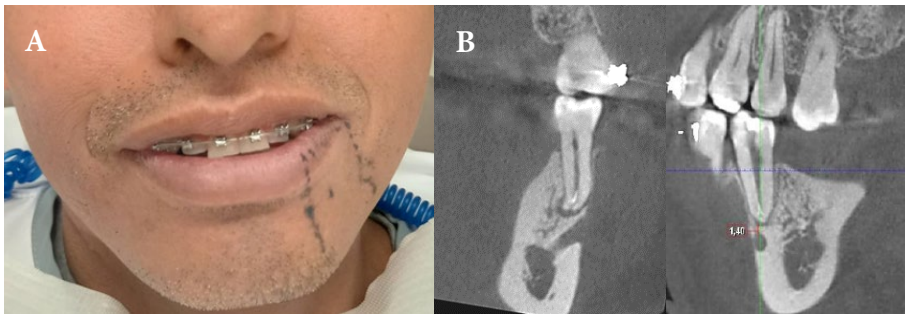

Figure 1. A) The skin in the region of the left mental nerve distribution presented with parestesia; *B)* CBCT images of the initial appointment

When administering local anesthesia, complications may occur. The success of the anesthesia depends on the injection methods and the anesthetic solution [9]. Paresthesia by anesthetic injections cause nerve damage, this damage may occur due to direct trauma by the needle, or the neurotoxic effect of the anesthetic solution or a combination of both [7, 10, 12].

The following case report discusses paresthesia in the area innervated by mental nerve, which occurred by anesthetic injection in a non-surgical endodontic treatment.

Case Report

This report was ethically approved from the Research Ethics Committee of the Faculty of Health Sciences at the Peruvian University of Applied Sciences. A 44-year-old man of Peruvian nationality and mixed racial origin, with no allergies or medications, a non-contributory medical history, with class 1 American Society of Anesthesiologists (ASA) physical status, and history of orthodontic treatment was referred to the Department of Endodontics. The patient reported moderate pain when chewing and exposure to cold. Upon clinical examination, the crown of the mandibular left second premolar was caries free, severe pain was reported in the horizontal and vertical percussion, the pulp vitality/sensibility test showed severe sensitivity to cold, when Endo-frost was used, excessive force was found to be exerted on the premolar when chewing and the rest of the dentition was subjected to the stress of orthodontic movements. Extension of the fracture line was in the mesiodistal surface of the premolar crown and was detected with 16× magnification of a microscope (Global Surgical Corporation, St. Louis, MO, USA). The radiographic examination showed a wide mental foramen and widening of the periodontal ligament.

The classification of cracked teeth was provided by the American Association of Endodontists [13], described as craze line and fractured cusp with a better prognosis after restoration compared to teeth with vertical fracture [14]. Multiple factors such as bite force and thermal cycling can cause crack lines on the tooth or damage the tooth structure. The management plan is different in each case, in some cases such as teeth with irreversible pulpitis and fracture line, root canal treatment is recommended [14]. Restored teeth with cracked tooth syndrome have a poor prognosis due to the risk of the further propagation of fracture line, but the survival rate at 5-year is between 74.1 to 96.8% which is considered as acceptable [15].

The main diagnosis was cracked tooth syndrome and endodontic diagnosis were symptomatic irreversible pulpitis along with symptomatic apical periodontitis; therefore, root canal treatment was indicated. The poor prognosis was discussed with the patient and informed consent was obtained from him.

An approximate volume of 2.6 mL of 2% lidocaine with epinephrine (1:100000) (Lignospan standard, Septodont, Lima, Perú) was administered with a gauge 30 (30 G), 21 mm needle (Nipro Pharma Packaging, Millville, NJ, USA), during injection the patient reported severe pain. The tooth was accessed under dental dam isolation, 16× magnification of a microscope (Global Surgical Corporation, St, Louis, MO, USA) was used for all clinical procedures. The working length was confirmed using an electronic apex locator (Root ZX, J. Morita, Tokyo, Japan), canal shaping was performed using Reciproc R40 (VDW GmbH, Munich, Germany), and irrigation was performed with 2.5% sodium hypochlorite using Navitip (Dentsply-Maillefer, Ballaiguess, Switzerland). During the mechanical preparation, a K-file #10 broke (Denstply-Maillefer, Ballaiguess,Switzerland) and remained in the canal. Glass-ionomer cement was placed into the access cavity (Vitremer, 3M ESPE, St. Paul, MN, USA).

The next day, the patient reported an altered sensation on left side of the mandible. Clinical evaluation of the mental nerve paresthesia was done using tests recommended by Robinson *et al.* [16].

1. *Mapping the injury area*: The skin and chin area of the lower left lip without response to sensory testing was mapped and recorded using a ballpoint pen on the patient's face (Figure 1A).

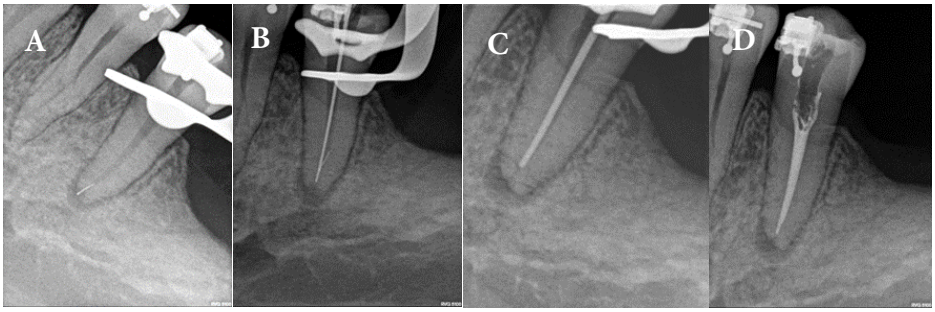

Figure 2. Root canal treatment of the mandibular left second premolar; *A*) A) Initial radiograph and K-file #10 broke; *B*) Conductometry (working length determination); *C*) Conometry (master cone confirmation); *D*) Obturation

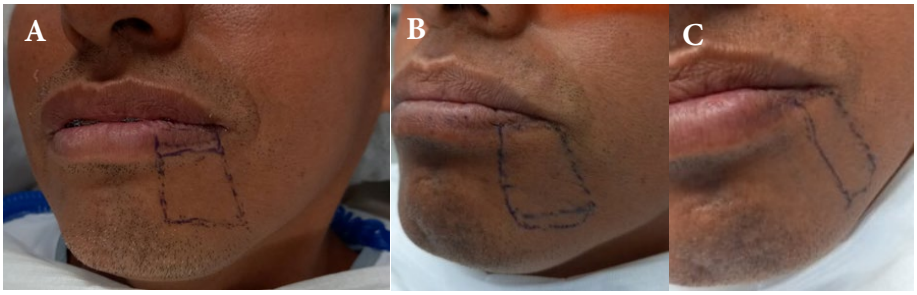

Figure 3. The skin in the region of the left mental nerve distribution presented with parestesia; *A*) 1-month control; *B*) 3-month control; *C*) 6-month control

2. *Function scoring*: The patient was asked to assess his level of sensory function on the affected side, as compared to the contralateral side, using a scale of 0-10 (0=no perception of touch, 10=normal perception). The patient reported 0.
3. *Light touch test*: The corner of a paper was moved over the injured area, the patient did not report any perception of light touch.
4. *Sharp discrimination test:* The patient was unable to differentiate between the sharp pricks made by both ends of a dental explorer.
5. *Two-point discrimination test***:** The patient was unable to discriminate a single pressure point (Figure 1A).

The patient was referred for a small field-of-view CBCT scan (Planmeca Promax 3D Max, Planmeca OY, Helsingfors, Finland) (74 kV, 10 mA (8×8×8), which confirmed the close proximity (1.40 mm) between the mental canal foramen and the apex of the second left mandibular premolar (Figure 1B). Mental nerve paresthesia was decided as the diagnosis and diclofenac sodium, thiamine, cyanocobalamin, and pyridoxine (Dolo-Neurobion Forte) were prescribed for 7 days as part of the treatment. Two weeks after the first visit, the patient reported numbness and electric shock sensation. To complete the root canal treatment, the tooth was re-accessed under dental dam isolation, the broken instrument was removed with ultrasonic activation by UltraX (Eighteeth, Changzhou Sifary Medical Technology, Changzhou, China) and bypassing was done by stainless steel hand K-files. The control radiograph showed complete removal of the broken instrument. The canal was irrigated with 2.5% sodium hypochlorite and 17% ethylenediaminetetraacetic acid, followed by a final rinse of sterile saline. After drying by paper points, the canal was obturated using Vioseal (Spident, Seoul, Korea), and gutta-percha cone with thermoplastic technique (Fast pack pro, Eighteeth, Changzhou Sifary Medical Technology, Changzhou, China). The access cavity was restored with glass-ionomer resin (Vitrebond, 3M ESPE, St. Paul, MN, USA) and composite resin (Filtek XTE, 3M ESPE, St. Paul, MN, USA) as a final restoration (Figures 2A-D).

Patient was scheduled for follow-up appointments after 1, 3, 6, and 8 months. After the first month the tooth had become asymptomatic, the feeling of paresthesia was still present, and the patient was experiencing a painful electric shock sensation (Figure 3A). After 3 months, the feeling of numbness was reduced, and the patient confirmed the continuation of consuming vitamin B12 (Figure 3B). After 6 months, remarkable improvement was observed and the area affected by paresthesia was significantly reduced, but a slight electric shock sensation was still present (Figure 3C). After 8 months the patient no longer reported symptoms of paresthesia and normal sensation had returned to the skin innervated by the left mental nerve. The repair of neurosensory function in the area was confirmed by the test that was previously performed at the beginning of case evaluation. Periapical radiography and CBCT scan showed that periapical radiolucency had disappeared, with adequate hard tissue formation between the apex and the mental foramen (Figure 4).

Figure 4. CBCT images after 8 months follow-up, tomography demostrated bone healing around the apex of the second premolar

Discussion

This is a case report about mental nerve paresthesia caused by local anesthesia injection, which was completely resolved after 8 months.

A possible complication of local anesthesia may be paresthesia; the contact of the needle with the nerve and hemorrhage may result in compression of the nerve. The longer persistence of mechanical or chemical irritation is associated with more degenerated nerve fibers and a higher risk of permanent paresthesia; anesthetic toxicity has been taken into consideration as well [6].

Baroni *et al.* [17] compared the toxicity of three anesthetics (used in rats): 4% articaine with epinephrine, 2% lidocaine with epinephrine, and epinephrine alone. The conclusion was that articaine is not toxic for nerve structure, and further studies are needed to clarify a possible relationship between articaine injection and paresthesia [18].

Tilotta-Yasukawa *et al.* [8] demonstrated in anatomic studies that the mandibular canal is not circumscribed by cortical bone, and the neurovascular bundle often goes through cancellous bone. This could explain that the pressure or diffusion of chemical or toxic substances may have a direct effect on the nerve structures [19]. The hydrostatic pressure of the injection and mechanical nerve compression results in a reduced blood flow to the nerve and its deformation, subsequently causing paresthesia [11, 20].

Baroni *et al.* [17] described that 48% of the paresthesia cases in the orofacial region had odontogenic etiology and the iatrogenic injury was the main reason of the local nerve damage, followed by the complications after the orofacial and maxillofacial surgery. The third molar surgery was the most common (63.1%); other reasons were the nerve damage associated to nerve block anesthesia (10.1%), dentoalveolar surgery (7.4%), implant surgery (10.7%) and root canal treatment (6.7%) [10].

The nerve injury during local anesthetic injection has a higher probability of full regeneration. Many cases resulted in neuropraxia, which is a temporary damage in the signal transduction characterized by the damage to the myelin sheath with no axonal injury [10, 21]. The resulting sensory loss was normally recovered within days or weeks, but in complex cases the recovery time extended to months [20, 22]. Treatment option for cases with odontogenic etiology are as follows: dental extraction, surgical treatment, and root canal treatment [9, 20, 23]; as a complement of treatment, the use of synthetic corticosteroids (dexamethasone), vitamin B12 and adenosine triphosphate to improve tissue regeneration is suggested. Vitamin B12 activates the central nervous system; this is important for the growth and replication, which have the capacity of maintaining optimal levels of homocysteine [9, 12].

Conclusion

Paresthesia may occur due to mental nerve damage by anesthetic injection. The exact damage mechanism may not be identified; it can be the direct trauma caused by the needle on the nerve and/or the neurotoxic effect of the anesthetic solution. It is necessary to know anatomic structures that may be affected during the root canal treatment. Always obtain a signed informed consent; mental nerve paresthesia is a rare complication, but it is important that the patient has knowledge.

Acknowledgment

The authors would like to thank Alejandro Escudero, Jorge Escudero, Pedro Munguia, Emma Osorio, Martin Vargas, Santiago Quijano, Armida Alvarez for their help, support and feedback.

Conflict of interest

None.

Funding support

None.

Authors' contributions

Conceptualization: RM, Methodology: CAZQ, Formal analysis and investigation: RM/CAZQ, Writing-original draft preparation: RM/CAZQ, Writing-review and editing: RM/CAZQ, Supervision: RM. All authors read and approved the final manuscript.

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Please cite this paper as: Munguia-Osorio R, Zevallos-Quiroz CA. Mental Nerve Paresthesia: Mental Nerve Paresthesia, a Complication of Anesthesia in Non-surgical Endodontic Treatment: A Case Report . Iran Endod J. 2025;20(1): e5. *Doi*: 10.22037/iej.v20i1.45478.