mastoid air cells extends into the subperiosteal space. Chronic otitis media with or without cholesteatoma can cause facial paralysis through involvement of a dehiscent nerve or through bony erosion. Facial paralysis secondary to COM or cholesteatoma generally has a slow progression and a worse prognosis.[13] Çilcan et al[10] reported mastoid abscess in 14 patients, labyrinthitis in 28 patients, facial paralysis in 12 patients, and labyrinthine fistula in 4 patients, totally 25 extracranial complications among 324 COM cases. They did not have any intracranial complication in patients who had extracranial complications.

However, in our case, we had 2 intracranial and 2 extracranial complications together, and the only complaint of the patient was about the facial paralysis. It is important to know that a patient could have multiple complications and one of the complications may mask the others. Even a sigmoid sinus thrombosis could mask the cerebellar abscess as mentioned in a clinical report.[14] Early diagnosis of intracranial complications may have been life saving.[11]

CONCLUSIONS

In this study, we aimed to emphasize that a patient may have multiple complications due to COM even if it has been talked that the complications of COM have been rarely seen recent years. In addition, our patient did not have any complicated complaints except facial paralysis and fever. This situation shows that the clinicians should be careful and keep in mind that a patient with minimal symptoms may have multiple COM complications together.

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Anterior Mandibular Zone Safe for Implants

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Abstract: During implantology procedures, one of the most serious complications is damage of the inferior alveolar nerve (IAN). The mandibular incisive nerve is described as a terminal branch of the IAN and provides innervation to the lower anterior teeth and canines. The incisive nerve and canal are located in the interforaminal area. Although numerous studies report IAN damage during implant placement, few reports in the literature describes sensory disturbances, such as neuropathic pain, related to mandibular incisive nerve damage.

The purpose of this retrospective clinical study was to evaluate the risk of neuropathic pain caused by implant placement in the interforaminal region of the mandible.

Panaromic radiographs of patients who were treated with dental implants in the Department of Maxillofacial Surgery, Faculty of Dentistry at Erciyes University, between 2007 and 2012, were examined. Fifty-five patients with suspected relationship between mandibular incisive canal and dental implant were included into this study. Computed tomography scans were obtained from 10 patients who have postoperative neuropathic pain. Relationship between dental implant and mandibular incisive nerve was evaluated using a three-dimensional software program. Mandibular incisive nerve perforation by at least 1 implant was observed in all 10 patients. Descriptive analyses were also provided.

Neuropathic pain may occur after implant placement in the interforaminal region due to the perforation of the incisive canal and nerve. According to the results of this retrospective study, the incisive canal and nerve perforation should be considered as a complication of implant surgery in the mandibular anterior area.

Key Words: Mandibular incisive nerve, dental implant, neuropathic pain, dental volumetric tomography

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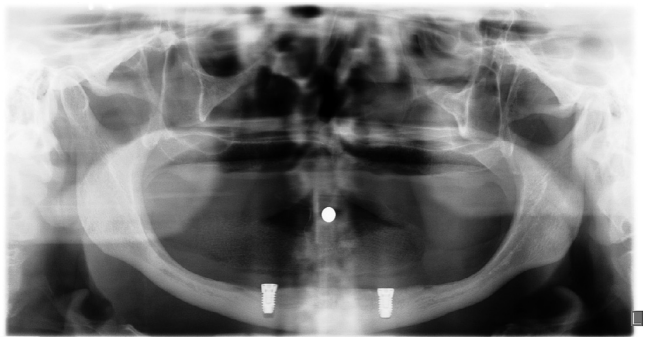

FIGURE 1. Patient 1: a panoramic view presenting implant-MIC relation.

Dental implant therapy has become a widely accepted treatment option over the past few years.[1] During implantology procedures, one of the most serious complications is temporary or permanent damage of the inferior alveolar nerve (IAN), which may result in sensory disturbances (SDs). Depending on the degree of the injury, the alteration in sensation ranges from mild paresthesia to complete anesthesia[2] and/or neuropathic pain.[3] The mandibular incisive nerve (MIN) is described as a terminal branch of the IAN[4] and provides innervation to the lower anterior teeth and canines.[5] The MIN and canal are located in the interforaminal area.[6] Although numerous studies report IAN damage during implant placement,[7,8] few reports describe SDs related to MIN damage.[9] However, this nerve has been recognized as a significant cause of such complications when harvesting bone from the interforaminal region.[6]

The purpose of this retrospective clinical study was to evaluate the risk of SDs caused by implant placement in the interforaminal region of the mandible.

MATERIALS AND METHODS

The study protocol was approved by the local ethics committee of Erciyes University. Patients who underwent dental implant surgery in the Department of Oral and Maxillofacial Surgery, Faculty of Dentistry at Erciyes University, between 2007 and 2012, were selected for examination. Fifty-five patients with suspected relationship between MIN and dental implant on postoperative panaromic radiographs were examined (Fig. 1). Patients with implants located in a distance less than 5 mm to the mental foramen were excluded from the study. Ten patients had dental volumetric computed tomography (DVCT) scans (NewTom 5G Cone Beam 3D Imaging, Verona Italy), which were taken upon patient's complaints related to implant surgery. Dental volumetric computed tomography scans were obtained in a 0.25-mm slice thickness. All scanning procedures were performed using a standard exposure and patient positioning protocol. Patients defined 2 types of pain as tingling/burning and/or throbbing in the region innervated by the MIN during clinical examination. Mechanoceptive tests were performed to determine the neurosensory changes. DICOM files of the DVCT images were imported into SimPlant Pro 2011 software program (Materialise Inc, Leuven, Belgium). All examinations were performed by 2 authors of this study who have experience of CT image interpretation and implant surgery. Mandibular and incisive canals were carefully detected and drawn on the cross-sectional images after segmentation procedure. The MIN was determined following its locations in sequence through the images. Relationship between dental implants and MIN was evaluated through axial, panaromic, and cross-sectional images.

RESULTS

An overview of the characteristics of the patients and descriptive data are given in Table 1. The mean age of 10 patients was 54.7 years, ranging from 44 to 64 years. Of 10 patients, 9 were female (90%), and 1 was male (10%). Of the 10 patients who have good health conditions, 9 were fully edentulous, and 1 was partially edentulous. A total of 19 dental implants were placed in the interforaminal region of the mandible in all patients. The implants were placed in left and/or right mandibular canine teeth region (teeth numbers 33, 43). None of the 10 patients reported dysesthesia, paresthesia, or anesthesia. Neuropathic pain was defined as tingling or burning by 8 patients (80%), whereas it was defined as throbbing by 2 patients (20%). The pain was continuous in all patients. Pain zone was unilateral in 90% of the patients, whereas it was bilateral in 10% of the patients. Pain duration of the patients ranged from 1 month to 4 years. Neuropathic pain has continued only for 1 month in 50%, 6 months in 10%, and 2 years in 10% of the patients after the operation. Neuropathic pain continues in 30% of all patients.

According to the DVCT examinations, MIN perforations related to 15 implants observed in 10 patients (Fig. 2). Four dental implants were found to be in close relationship (<1 mm) with MIC (Fig. 3).

DISCUSSION

The mandibular incisive canal (MIC) is a continuation of the mandibular canal anterior to the mental foramen. The canal contains the incisive bundle that innervates the teeth in the interforaminal region

TABLE 1. Summary of Patient Characteristics

Patient	Sex	Age, y	Implant Zone	Complaint	Duration	Implant-MIN Relation
1	Female	57	33–43	Tingling	One month	Touching, both
2	Female	58	33–43	Tingling	One month	Touching, both
3	Female	56	33–43	Tingling	One month	Touching, both
4	Female	64	33–43	Tingling	Two years	Close, both
5	Female	44	44	Tingling	One month	Close
6	Female	53	33–43	Tingling	Six months	Touching, both
7	Female	51	33–43	Tingling	Continues	Touching, both
8	Female	61	33–43	Throbbing	Continues	Left touching, right close
9	Female	47	33–43	Tingling	Continues	Touching, both
10	Male	56	33–43	Throbbing	One month	Touching, both

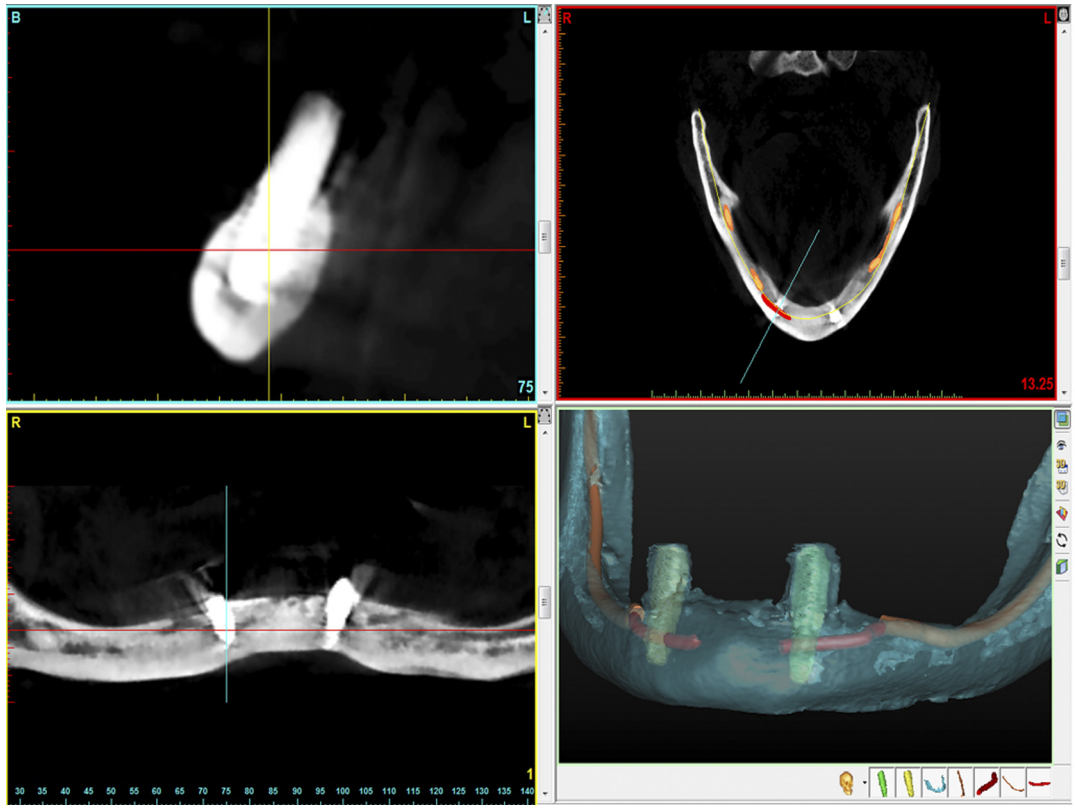

FIGURE 2. Patient 1: DVCT images presenting perforation of the MIN by dental implant in sagittal, axial, panoramic, and three-dimensional views.

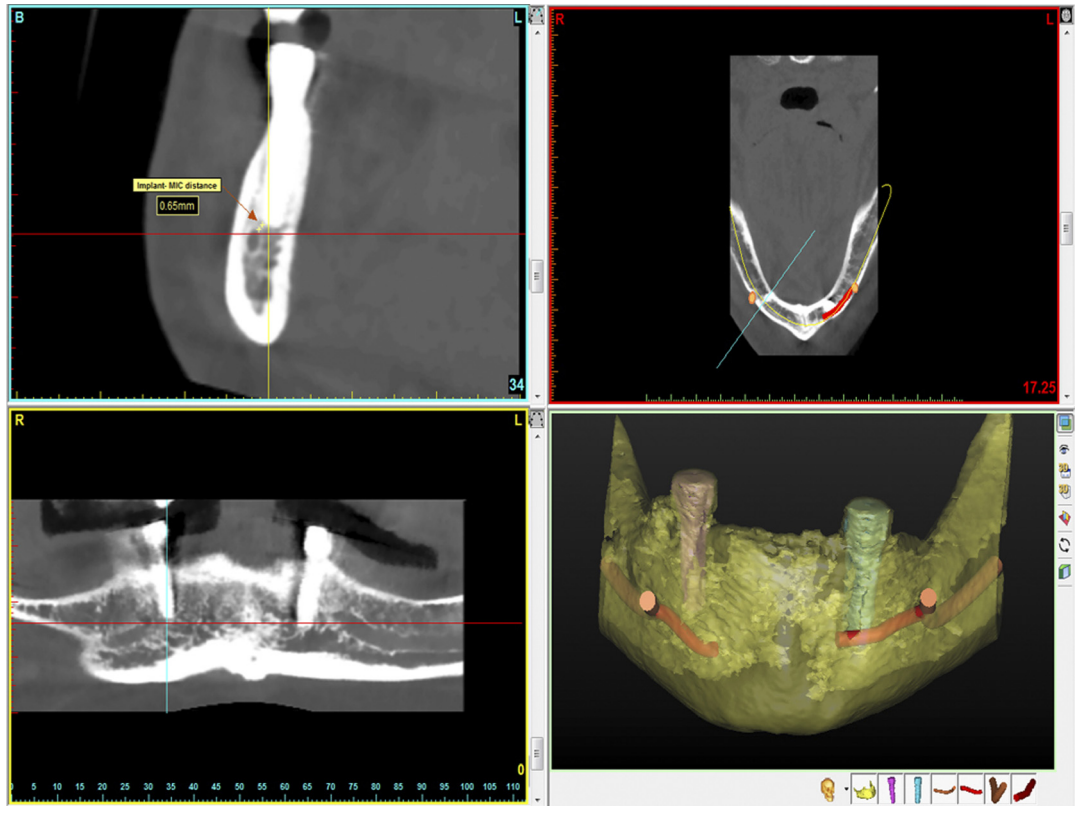

FIGURE 3. Patient 8: DVCT images presenting close relation of MIN with dental implant in sagittal, axial, panoramic, and three-dimensional views.

of the mandible.[10] It has increasingly been recognized as an important anatomical structure that needs to be taken into consideration when planning surgical procedures in this area.[6] However, debates over the clinical importance of MIC still exist among the clinicians, who perform dental implant surgery.

Mandibular interforaminal region is involved in various surgical procedures including bone harvesting, orthognathic surgery, distraction osteogenesis, and dental implant surgery. Although the old concept considers this region as a "safe zone," recent reports indicate many complications related to implant surgery[11,12] or bone harvesting.[13]

Discomfort, pain, and neurosensory disturbances can develop as a result of IAN injury during dental implant insertion in the posterior mandible. This complication is one of the most unpleasant experiences from mild paresthesia to complete anesthesia and/or pain.[2] Continuous pain, sometimes of a burning quality, is characteristic of posttraumatic neuropathy,[3] which can also occur by injury to the peripheral nerves.[14]

Although alterations in sensation are mostly related to IAN or mental nerve injuries, a few reports describe neurosensory disturbances resulting from mandibular nerve injury. Kohavi and Bar-Ziv[9] described a case in which pain and discomfort occurred after the insertion of dental implants in the interforaminal region of the mandible. Computed tomography images showed that the implants were placed in the MIC. Wismeijer et al[12] evaluated dental implants inserted in the mandibular anterior area in 110 edentulous patients, and they found permanent SD in 7% of the patients. Ten patients with neurosensory disturbances that occurred after dental implant surgery were examined in our study. All implants were inserted at least 5 mm anterior to the mental foramen. Panoramic radiographs and DVCT examinations confirmed at least 1 MIC perforation by an implant in each patient. The patients defined their discomfort either as a continuous tingling, burning, or throbbing pain. This complication may have arisen from either a direct injury to the incisive nerve or an indirect injury to the neurovascular bundle.

Different methods have been used to evaluate SDs after the placement of dental implants such as soft brush, 2-point discrimination, pain perception, and temperature sensitivity[15] or light touch sensation test with a questionnaire after oral implant placement in the anterior mandible.[12] Two-point discrimination and/or light touch sensation tests in conjunction with a standard questionnaire was used to evaluate postoperative SDs in the current study. One of the drawbacks of the current study is, because only the patients with postoperative complaints were examined with sensory tests, we do not know the incidence of such complications among the patients treated with dental implants in the interforaminal region. Therefore, prospective studies with larger sample sizes, evaluating the incidence and the relation of SDs with perforation of MIC by dental implants, are needed.

The identification of MIC using conventional radiographs is often limited. Recent cadaveric or CT studies indicate the presence of MIC and its nerve. Wadu et al[16] examined 29 human mandibles radiographically and anatomically after dissection. The dissections revealed the incisive bundle of IAN formed a curvature as it coursed down from mental foramen, rising medially to innervate the canine and incisor teeth. In a more recent study,[10] an incisive bundle was anatomically defined in 46 hemimandibles, travelling within a canal with complete, partial, or no bony cortical plates. These canals were either well or poorly defined or undetectable on radiographs. The current study shows the direct or close relation of dental implants with MIC. This result is consistent with recent studies using CT, cone beam CT, or magnetic resonance imaging.[6,17–19] To identify the course of MIC, we used SimPlant software program, which was suggested as a useful equipment to identify the incisive canal in a study of morphometric analysis with cone beam CT images.[6]

In conclusion, neurosensory disturbances, discomfort, and pain may occur after implant placement in the interforaminal region due to the perforation of the incisive canal and nerve. According to the results of this retrospective study, this complication should be avoided using CT or DVCT as a part of preoperative planning of implant surgery in the mandibular anterior area.

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