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Case Report
Neuropathic pain resulting from implant placement: case report and diagnostic conclusions

M. LECKEL*, B. KRESS† & M. SCHMITTER* *Departments of *Prosthodontics and †Neuroradiology, University of Heidelberg, Heidelberg, Germany*

SUMMARY Temporary or persisting dysesthesia of the nervus alveolaris inferior has often been described as a complication of implant surgery of the lower mandible. In most cases, lesion of the nerve results in anaesthesia of the innervated region, a symptom clearly indicative of correct diagnosis. In our case report, however, a minor perforation of the roof of the mandibular canal during implant placement apparently provoked discrete irritation of the nerve, resulting in persistent neuropathic pain without concomitant hypesthesia or dysesthesia. Because the canal could not be detected in conventional dental radiographs, this uncharacteristic situation made correct diagnosis difficult and led to unnecessary surgical procedures including extraction of adjacent teeth. Medical imaging [computed tomography (CT)] finally revealed the close proximity of the apex of the implant and the bony structure of the mandibular canal. The effect on the nervus alveolaris inferior was also demonstrated using an innovative high-resolution dental magnetic-resonance-imaging technique reflecting vascular reactions of the neurovascular bundle after potentially damaging surgical intervention. After removal of the causative implant, the pain gradually faded over a period of a year.

KEYWORDS: neuropathic pain, implantological complication, CT, dental magnetic-resonance-imaging, nervus alveolaris inferior

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Case report

In February 2002, two cylindrical enossal implants (Straumann type) were placed in the left posterior region (36/37) of the mandible of a patient with a shortened dental arch. The pre-operative situation is shown on the panoramic X-ray in Fig. 1. One week after surgery a continuous burning pain set in, localized to the premolar region of the left mandible. No sensory deficit, e.g. dysesthesia or anaesthesia, was reported by the patient. In the period following, both premolars were endodontically treated, consecutively root resected and later extracted. However, the serious pain was not affected.

In July 2003, the patient was referred to our clinic. The 56-year-old otherwise healthy man complained of persistent pain with piercing–burning character in the region innervated by the nervus alveolaris inferior. The patient did not report any somatosensory disturbances in addition to the pain. Basic sensory tests, such as touching the skin of the cheek and chin with a cotton swab or applying cold or heat with a metal instrument, did not reveal any abnormalities. When tactile spatial discrimination was tested with a dental calliper, no difference compared with the contralateral side was observed. A temporomandibular disorder (TMD) exam observing the guidelines of the 'Research Diagnostic Criteria for TMD' proved also normal. The pain fluctuated slightly throughout the day, but was never subdued completely. As the surgical procedures had been to no avail, the patient had, for months, been prescribed a tilidine/naloxon hydrochloride analgesic (Valoron N*) by his general practitioner. With this

*Goedecke GmbH, Karlsruhe, Germany.

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Fig. 1. Situation before implant placement.

Fig. 3. Panoramic X-ray made after admission.

Fig. 2. Intra-oral situation at the time of admission.

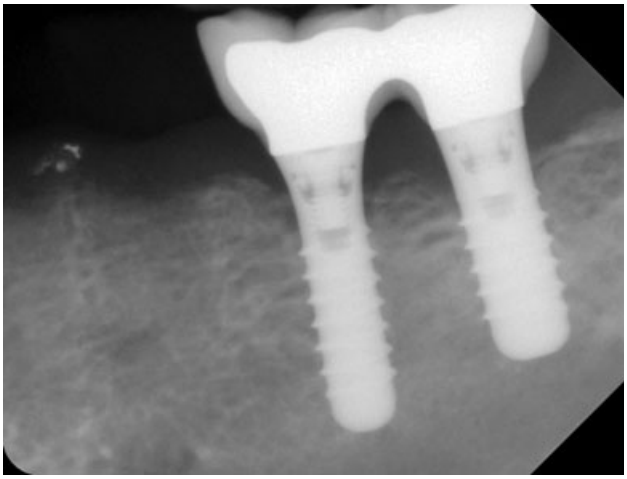

Fig. 4. Digital X-ray made after admission. Neither in this view nor in the panoramic X-ray image can bony outlines of the canalis mandibularis be discerned.

medication, he reported a level of II (high intensity, low disability) on the Graded Chronic Pain Status scale (1). Nevertheless, he was able to fulfil the needs of his daily life, although slightly impaired by the side effects of the drug (weariness, dizziness). Sleep quality was unaffected. Figure 2 shows the intra-oral situation at the time of admission.

Conventional radiography (panorama and apical dental X-ray) did not reveal the bony outlines of the canalis mandibularis close to the apex of the implant (Figs 3 and 4). Pharmacological treatment with carbamazepine reduced the pain intensity slightly. Because the response of the patient to the medication indicated he had a neuropathic pain condition and conventional radiographs did not reproduce the canalis mandibularis clearly, additional computed tomography (CT) radiography[†] was arranged.

With this imaging procedure, the close topical proximity of the apex of the anteriorly situated implant and the bony structure of the mandibular canal was finally revealed (Fig. 5). To further clarify any functional effect on the nervus alveolaris inferior, a novel high-resolution dental magnetic-resonance-imaging (dMRI) technique using quantitative analysis of imaging data was applied (2) (1·5-tesla MRI[‡]). Regions of interest (ROI)

[†]Siemens Somatom, Forchheim, Germany.
[‡]Symphony Siemens, Forchheim, Germany.

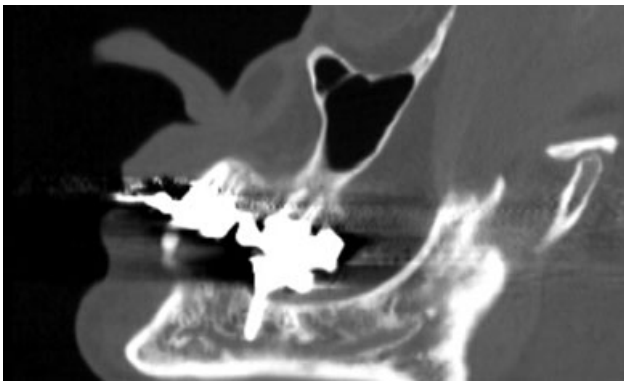

Fig. 5. CT radiography. The close proximity of the apex of the anteriorly situated implant and the bony structure of the mandibular canal is apparent.

Fig. 6. Dental magnetic-resonance-imaging (dMRI). Regions of interest (ROI) are defined along the alveolaris inferior neurovascular bundle.

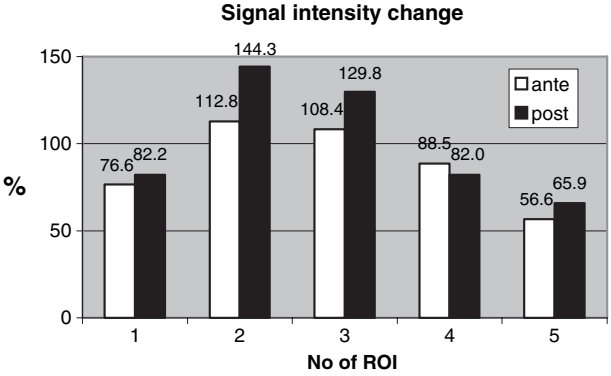

Fig. 7. The dMRI. Augmentation of signal intensity after application of contrast material results most distinctively in ROI No.2 and 3.

were defined along the alveolaris inferior neurovascular bundle distal and proximal to the implants. Signal intensity within the ROI was measured and compared before and after intravenous application of paramagnetic contrast material (gadopentetate dimeglumine[§]). In two ROIs proximal to the implant, a distinctive increase in the signal could be observed, indicating augmented blood flow in this part of the neurovascular bundle (Figs 6 and 7). On the basis of these findings, the decision was taken to remove the anterior implant and this was performed without further complications (Fig. 8). In the following months, analgesic medication was gradually reduced and finally discontinued. Intermittent, short-term pain episodes could be managed by the patient by applying topical 0·025% capsaicin cream (3) with a cotton swab. One year later, the patient was essentially pain-free to an amount that did not require further treatment.

Discussion

The literature dealing expressly with neuropathic pain associated with implant placement is rare (4, 5). In the implantology literature, nerve-related complications are predominantly subsumed in the term 'sensory disturbances', apparently focusing on the occurrence of paresthesia and dysesthesia (6–8). In two comprehensive literature reviews, occurrence of these complications ranges widely—between 0% and 19% (9) and between 0·6% and 39% (10), respectively. The latter gives 'a mean incidence of 7%', a number that Jokstadt (11) assumes is inflated by methodological flaws.

From the literature, one might gain the impression that implant-related nerve lesion would usually result in paresthesia or dysesthesia, eventually accompanied by transitory pain sensations during bone drilling or implant placement. The case at hand, however, demonstrates that in rare circumstances post-operative chronic pain can occur without accompanying somatosensory disturbances such as hypesthesia or anaesthesia. This eventuality should be considered to prevent unnecessary and even disadvantageous invasive

[§]Magnevist Bayer Schering Pharma, Berlin, Germany.

Fig. 8. The implant surgically removed. Note the absence of adhering bone in the apical region.

measures. Further, the benefit of modern three-dimensional imaging techniques is manifestly helpful in clarifying the topical relationships between implants and anatomical detail (CT) and in investigating functional aspects of the neurovascular bundle (dMRI).

As the patient had been seen by a neurologist previously, a more comprehensive neurological examination, notably quantitative somatosensory testing (QST), had not been conducted in our clinic, which might be regarded as a limitation in this case report. Thus, to gather valuable clinical data and possibly minimize intricate and expensive diagnostic procedures further, a systematic diagnostic approach, including QST should be adapted by the dentist.

Conclusions

The case emphasizes the need for carefully evaluating anatomical conditions before inserting implants proximate to neural structures in the mandible. It also reveals the need for using extensive diagnostic resources such as CT or MRI before the use of potentially damaging invasive measures. Before applying elaborate and costly procedures such as these, basic somatosensory methods of assessing pain of neuropathic origin are indicated (12).

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Correspondence: M. Leckel, Poliklinik für Zahnärztliche Prothetik, Im Neuenheimer Feld 400, D-69120 Heidelberg, Germany.
E-mail: michael.leckel@med.uni-heidelberg.de