Post-implant neuropathy

doi: http://dx.doi.org/10.1590/2237-650X.7.4.085-089.lit

Abstract / The use of dental implants in partial or total edentulous arches is considered the gold standard of oral rehabilitation. This procedure has high success rates mainly due to the advanced features of imaging exams such as cone beam computed tomography (CBCT). However, some intra- and postoperative complications may occur. One potential complication is post-implant neuropathy (PIN), a traumatic trigeminal neuropathy caused by direct or indirect nerve trauma. The most affected nerves are the inferior alveolar nerve and lingual nerve. This condition can be clinically reported as anesthesia, paresthesia, hypoesthesia, hyperesthesia and/or dysesthesia. PIN is not a frequent condition, but it significantly affects patient's social life. Additionally, it is very difficult to be diagnosed and treated. The aim of this article is to review the literature about PIN so as to clarify its concept, possible causes, as well as best diagnostic and treatment approach.
/ Keywords / Neuropathic pain. Post-implant neuropathy. Dental implants.

Carolina Ortigosa **Cunha**
Doctorate student of Applied Dental Sciences, School of Dentistry — University of São Paulo (USP).

Lívia Maria Sales **Pinto-Fiamengui**
Doctorate student of Applied Dental Sciences, School of Dentistry — University of São Paulo (USP).

Fernanda Araújo **Sampaio**
MSc in Dental Sciences, University of Medicine and Dentistry of New Jersey.

Jorge Francisco **Fiamengui-Filho**
Doctorate student of Applied Dental Sciences, School of Dentistry — University of São Paulo (USP).

Paulo César Rodrigues **Conti**
Full professor, Department of Clinical Dentistry, FOB-USP.

How to cite this article: Cunha CO, Pinto-Fiamengui LMS, Sampaio FA, Fiamengui-Filho JF, Conti PCR. Post-implant neuropathy. Dental Press Implantol. 2013 Oct-Dec;7(4):85-9. DOI: http://dx.doi.org/10.1590/2237-650X.7.4.085-089.lit

Submitted: August 15, 2013 - **Revised and accepted:** September 16, 2013

Contact address: Carolina Ortigosa Cunha
Email: carol.ortigosa@gmail.com

The authors inform they have no associative, commercial, intellectual property or financial interests representing a conflict of interest in products and companies described in this article.

INTRODUCTION AND LITERATURE REVIEW

Orofacial neuropathic pain is defined as pain in the orofacial region initiated or caused by primary injury or central or peripheral nervous system dysfunction.[1] Peripheral traumatic neuropathy can occur after dental procedures such as tooth extraction, endodontic treatment and dental implants placement.[2,3]

Dental implant placement has been a common treatment option for reconstruction of simple or complex edentulous areas of the maxilla and mandible. Currently, due to an increasing number of resources providing diagnostic information, e.g., cone beam computed tomography, complications during implant surgeries are less common; however, some surgical complications may occur, among which the most common are associated with bleeding, damage to adjacent teeth, mandibular fractures and PIN mainly affecting the mandibular and maxillary division of the trigeminal nerve.[4]

In 2007, Libersa, Savignat and Tonnel[5] conducted a 10-year retrospective study about patients' complaints made to the French health insurance about lower neurosensory disorders of the inferior alveolar nerve, transient or permanent, after dental procedures. In this study, the percentage of risk of complications after implant placement was 0.008% and 0.006% for persistent lesions.

Post-implant neuropathy can be developed days, weeks or even months[2] after surgery, which may confuse the dentist. Because it is a condition of difficult diagnosis and treatment, of debilitating symptoms and high emotional impact, understanding neuropathic pain in the head and neck is essential. In the long run, this painful condition can directly affect the mechanisms of confrontation and response to stress, anxiety, depression and treatment expectations. Moreover, the condition involves procedures that usually do not cause pain or nerve damage, for this reason, many ethical and legal factors are involved.[6,7]

This article aims at reviewing the literature on postsurgical neuropathy after dental implant placement (PIN), and at suggesting a treatment protocol.

According to the literature, the risk of permanent neuropathic complications after dental implant placement is of 13%,[8] with the inferior alveolar nerve and the lingual nerve being most often affected.[9] These damages can be classified as direct or indirect. Direct damage is restricted to direct neural trauma such as those caused by the needle used for anesthesia, the bur and/or retractors used during the preparation of the surgical site or by the implant itself.[9] Indirect damage is restricted to postsurgical situations such as bleeding and pressure around the nerve,[2] action of chemical irritants during inflammation or infection of the peri-implant region, nerve compression by the trabecular bone after implant installation or during the osseointegration process.[9,10]

The sensory processing established during a neural injury or neuritis (nerve inflammation) alters the activity of different nerve fibers. As a consequence, these conditions are clinically presented in a variety of ways, namely: anesthesia, paresthesia, hypoesthesia, hyperesthesia and/or dysesthesia.[2,11] Anesthesia is the total absence of feeling, even the absence of pain sensation. Paresthesia ("formication") includes a wide variety of abnormal sensations such as the "pins and needles" sensation which may not be completely unpleasant. Hypoesthesia is the decreased sensitivity to stimulation, while hyperesthesia is an abnormal increase in sensitivity. Last but not least, dysesthesia is an abnormal and unpleasant sensation, induced or spontaneous, such as allodynia (pain caused by painless stimuli) and hyperalgesia (exaggerated and quick pain response caused by painful stimuli).[9] When there is minimum nerve damage, the inflammatory process primarily affects A-beta myelinated nerve fibers, causing a reduction in the detection threshold (i.e., hypersensitivity) to stimulus. Nerve damage itself affects all types of nerve fibers, A-beta, A-delta and C-fibers, causing increased detection threshold to stimulus, i.e., hyposensitivity.[12,13]

In 2012, Renton et al[7] published a prospective review of 30 cases of inferior alveolar nerve injury associated with dental implant placement surgery. All patients developed some kind of sign and/or symptom of neuropathy, 50% of cases had neuropathic pain, out of which 30% had mechanical and thermal allodynia. Paresthesia was reported by 47% of the cases. Anesthesia was reported by 40% of patients of which four cases reported anesthesia and pain, and four cases reported anesthesia and paresthesia. Eleven patients reported mechanical allodynia, 14 had mechanical hyperalgesia, 7 had cold allodynia and four had cold hyperalgesia.

DIAGNOSIS AND TREATMENT

The diagnosis of peripheral nerve injuries, such as PIN, is a challenge that partially occurs as a result of lack of valid complementary methods. Several studies suggest the use of quantitative sensory testing (QST) to access the sensory function of injured nerves.[14]

According to a literature review conducted by Juodzbalys et al, the QST can be classified as subjective or objective. Subjective tests are based on patient's response and are the most popular in clinical practice. They are subdivided into mechanical-receptive test which uses material such as toothbrush, brush and wooden sticks for sensory discrimination and two-point discrimination testing; and nociceptive tests performed with the aid of material, such as pins and heat, that trigger response of nociceptive fibers. Subjective tests also include diagnostic blockade of nerve by means of a local anesthetic. Conversely, objective tests assess the function of the nerve itself. They include trigeminal somatosensory test with evocation of neural action potentials, orthodromic action potential test of sensory nerves and the blink reflex test.

The safest option to avoid injury of this nature is based on the use of diagnostic imaging performed to accurately determine and safely correct three-dimensional positioning of an implant in relation to the nerve branches. Panoramic radiographs are commonly used for this purpose, however, in some cases, a single neurovascular bundle of the inferior alveolar nerve cannot be visualized. These vascular and nerve branches are more easily identified by computed tomography.[15] In addition, methods of preemptive analgesia —such as correct anesthesia and/or preoperative prescription of pain and inflammatory medication — used to prevent or reduce postoperative pain by decreasing the sensitization of peripheral nerves, has also proved shown effective against nerve injuries, such as neural disorders after dental implant placement.[16]

According to Alhassani and Alghamdi,[17] a proper understanding of the anatomy involved in implant placement, surgical procedures and implant systems combined with an appropriate treatment plan, reduces the chance of unpleasant complications. However, should nerve damage occur, an appropriate and prompt treatment approach is key to maximize the chances of recovery.

There is no current well-defined protocol aimed at treatment of post-implant neuropathies. For all cases of dental implant surgery, it is recommended that the dental surgeon contact the patient after the period of action of the anesthetic not only to ensure that the patient has recovered the feeling in the area, but also to assess whether there are symptoms of a potential neuropathy.[18] Should dentists suspect of a possible neural injury, they must conduct studies of sensory function, mapping and photographing the affected area for further monitoring.[9]

Hegedus and Diecidue[19] recommend that implants be immediately removed, suggesting that they be reimplanted a few days later. According to Khawaja and Renton,[18] early implant removal (within 36 hours after surgery) may decrease neuropathy and even fully recover sensory function in cases of direct damage to the nerve. Drug therapy is an additional treatment that favors prognosis. It should be based on the level of injury severity: in case of mild injury, the use of high doses of nonsteroidal antiinflammatory drugs (NSAIDs) is indicated; however, in case of moderate to severe injury, steroids should be administered orally; and in more complicated cases, other pharmacological agents, such as antidepressants and anticonvulsants, should be used.[9] Benoliel et al[2] suggest the use of tricyclic antidepressants and membrane stabilizers, such as gabapentin/pregabalin as the first choice of treatment in cases of traumatic painful trigeminal neuropathy.

Juodzbalys et al[9] suggest a sequence of treatment for injuries to the inferior alveolar nerve. The protocol consists of six steps: 1) Confirmation of nerve injury through clinical and radiographic examination; 2) Identification of potential risk factors which may be general (patient's age, nerve and mandibular canal anatomy); during the surgical procedure (visualization of the damage), or postoperative (injury severity and the time interval since the injury was caused); 3) Identification of the etiological factor; 4) Diagnosis of sensory disturbances in the region; 5) Treatment; and finally, 6) Monitoring.

Topical medication may also be used. They are capable of reducing continuous peripheral stimulation in the initial stage of neuropathy, thus minimizing the development of central sensitization or central neuropathy. These drugs have less adverse effects when compared to systemic

methods, which favors their use in systemically compromised patients and elderly patients.[20]

Monitoring the sensory changes is extremely important to analyze patient's prognosis of recovery. Improvements in neurosensory symptoms usually occur within two to three months.[21] Improvements or remission of neurosensory disorders will depend on how soon the clinician identifies the problem and makes the correct diagnosis and treatment. Thus, the earlier the diagnosis, the better the prognosis of the case.

CONCLUSION

In short, postoperative follow-up of patients undergoing surgery for dental implants is essential. Should any nerve injury occur, it may be treated as early as possible, which leads to a better prognosis. Dental implant removal is recommended for cases of direct injury to the nerve or cases in which this nerve is very close to the mandibular canal. The procedure must be carried out within 36 hours after surgery. Should direct neural injury not be the case, early administration of corticosteroids or NSAIDs is strongly recommended. In case of late diagnosis of PIN, medications that have an effect on the central nervous system, such as antidepressants and anticonvulsants, must be used.

It is worth noting that the prevention of nerve damage during implant placement is the best way to avoid potential postoperative complications. This prevention is a result of appropriate surgical planning performed with the aid of accurate and high definition radiography. Additionally, in case of post-implant neuropathy, the clinician's main role is to identify the problem and refer the patient to a specialist in orofacial pain who will perform a multidisciplinary treatment.

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