Subjective assessment of inferior alveolar nerve function after lateralization surgery

Cleiton Gaubi **CAMPOS***
Ana Paula **PICCOLI****
Fabiano Carlos **MARSON*****
Mário dos **ANJOS NETO-FILHO*****
Luiz Fernando **LOLLI*****
Cléverson O. **SILVA******

Abstract

Introduction: Inferior alveolar nerve lateralization is an option to treat atrophic mandibles whose rehabilitation with prostheses may be limited due to vertical resorption in the posterior region and the short distance between the mandibular canal and the alveolar ridge. This surgery may result in paresthesia and sensory disturbances along the nerve path. **Objective:** To evaluate inferior alveolar nerve function and patient satisfaction after lateralization **Methods:** Twenty lateralization procedures were performed together with immediate placement of 52 implants. The same surgeon operated on all patients following a standardized surgical protocol. Six months after surgery, the patients answered a questionnaire about sensory changes after surgery and satisfaction with the results of the procedure. **Results:** All patients reported initial transient sensory disturbances and improvement at a mean 45 days after surgery, and some reported improvement after the third day. One had not recovered completely after 6 months. Despite sensory changes, all patients would undergo the procedure again if necessary and would recommend it to others. **Conclusions:** Inferior alveolar nerve lateralization seems to be safe and predictable, with minimal and reversible sensory changes and no significant damage to patients when performed according to a standardized surgical protocol.

Keywords: Mandibular nerve. Oral surgery. Dental implants.

How to cite this article: Campos CG, Piccoli AP, Marson FC, Anjos Neto-Filho M, Lolli LF, Silva CO. Subjective assessment of inferior alveolar nerve function after lateralization surgery. Dental Press Implantol. 2013 Jan-Mar;7(1):71-8

» 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.

Contact address

Cléverson de Oliveira e Silva
Av. Mandacaru, 1550
CEP: 87.080-000 – Maringá/PR, Brazil
E-mail: cosilva@uem.br

Submitted: July 02, 2012
Revised and accepted: November 20, 2012

* Student, Master's Degree Program in Dentistry / Dental Prosthesis, Uningá Dental School (Maringá, Brazil).
** Specialist in Implantology, FASURGS (Passo Fundo, Brazil).
*** Adjunct Professor, Master's Degree Program in Dentistry / Dental Prosthesis, Uningá Dental School.
**** Adjunct Professor, Periodontics, Universidade Estadual de Maringá (UEM) and Uningá Dental School.

Introduction

The loss of posterior mandibular teeth leads to vertical bone resorption and limits the possibilities of surgical and prosthetic rehabilitation. In some cases, bone loss may be severe, and the placement of conventional implants is impossible. In such cases, rehabilitation options include the use of devices for osteogenic distraction, bone grafts, guided bone regeneration and the placement of implants lateral to the nerve, as well as inferior alveolar nerve lateralization (IANL) by moving the nerve laterally from its canal, or the inferior alveolar nerve transposition.[1-4]

After tooth loss, the alveolar ridge undergoes continuous and irreversible vertical bone resorption. This loss of bone height is assigned to the loss of teeth and the compression of the alveolar ridge due to the use of removable dentures. Therefore, bone resorption in the posterior mandible usually results in a shorter ridge, and, consequently, the placement of implants in this region becomes a challenge.[5]

Several surgical techniques have been developed for the rehabilitation of atrophic mandibles using osseointegrated implants.[6]

Onlay bone grafts require a second surgical site and result in a certain degree of resorption, risk of infection and two surgeries, which increases total treatment time.[3,6,7]

Bone quality in the posterior mandible is inferior when compared with the anterior region, and when short implants are chosen — so that the mandibular canal is spared —, initial implants' anchorage is monocortical and they are not very stable.[8]

The amount of bone above the mandibular canal is often insufficient for the placement of implants with a desirable length. Moreover, the bone above the mandibular canal has often lower quality than cortical bone. These factors, together with the higher rate of failure associated with short implants, led to the development of IANL techniques, which create the conditions for the placement of longer implants that reach the lower mandibular cortical bone and ensure greater initial stability.[9]

The current IANL technique has proven to be a good alternative to treat cases with vertical mandibular atrophy.[10] The nerve is exposed and carefully pulled out of the mandibular canal and moved laterally from its path so that the implants can be placed without disturbing the incisive nerve. This technique has stable results, and the implants can be fixed to the two cortical layers, which increases resistance to occlusal forces and ensures a good implant-to-prosthesis ratio.[11]

In the case of nerve transposition, the mental foramen is involved, and the incisive nerve is sectioned. Inferior alveolar nerve (IAN) transposition results in loss of sensation of its terminal incisive branch, which is insignificant in patients with no teeth in the anterior mandible, but may disturb dental and periodontal sensibility when the patient has anterior teeth.[12]

The greatest clinical difficulty associated with IANL is transient or permanent nerve dysfunction. All patients that undergo this surgery may experience neurosensory disturbances that often include paresthesia.[13]

IANL is a high risk surgery because it may result in reduced sensibility, paresthesia or total loss of sensibility in the region. Therefore, the surgeon that performs this procedure should master the operatory technique and be familiar with the anatomy of the region, as well as with the path of the mandibular canal and the physiology of the neurovascular bundle.[14]

Studies with objective and subjective tests have reported on the occurrence of sensory changes in a high percentage of cases, but most studies have been conducted with samples of patients from different surgeons, which makes it difficult to standardize the surgical technique because it is not possible to calibrate all surgeons for tissue manipulation.[14,15,16]

Thus, the present study subjectively evaluated IAN function after lateralization and simultaneous implant placement, besides the satisfaction of the patients that underwent this procedure.

Material and Methods

Twenty patients that underwent IANL evaluated their postoperative outcomes. Patients selected for the study were in good health, did not smoke and had no systemic diseases. They all had severe posterior mandible atrophy and chose to undergo rehabilitation using implants.

Inclusion criteria were: age greater than 18 years; IANL with immediate placement of osseointegrated implants; and follow-up until second-stage surgery for the placement of healing caps six months after IANL. Patients were operated on by the same surgeon following the same surgical protocol, from January 2010 to December 2011.

Exclusion criteria were: time from surgery shorter than six months; or abandoned the treatment.

Six months after IANL, the implants were re-exposed for impressions and prosthesis fabrication. At that time, the patients received a questionnaire about their satisfaction with surgery and were asked whether they would undergo surgery again, if necessary, and whether they would recommend this procedure to another person. No patient underwent neurosensory testing after surgery.

Before surgery, cone beam computed tomography scans were obtained to define IAN position.

Pre-operative oral medication was prescribed: 4 mg dexamethasone one hour before, and 15 mg midazolam for conscious sedation 15 minutes before the procedure.

Surgical technique

Regional inferior alveolar nerve block was combined with anesthesia of the buccal nerve and bundle in the buccal fornix using 4% articaine and adrenalin, as a vasoconstrictor agent, at 1:100,000 (72 mg + 18 µg/carpule).

As this surgery is always associated with implant placement, an incision was made along the entire thickness of the bone crest, extending posteriorly to the beginning of the ascending ramus and widely exposing the body of the mandible, and anteriorly to beyond the mental foramen, together with relaxing incisions in the canine and retromolar regions.

After total flap elevation and exposure of all the mandibular body and mental foramen, a tungsten bur was used to level the ridge crest. Later, the osteotomy area was outlined using a surgical marker to prepare the bone window. A #702 bur for straight hand piece was used for the superior horizontal and medullary osteotomy, followed by vertical distal, vertical mesial and inferior horizontal osteotomy (Fig 1). An osteotome was used to displace the bone block, and special attention was paid to avoid any injury to the neurovascular bundle. After that, the marrow was removed using a Molt periosteal elevator to detect the cortical layer along the entire mandibular canal. The osteotome was placed above and below the nerve, and the cortical layer was ruptured; immediately after that, the periosteal elevator was used to remove the cortical layer of the canal (through its vestibular surface, inferior and superior to the canal). With a hook-shaped handpiece, the nerve was release along its entire length and pulled

buccally with slight movements, and a piece of band was used to retract it delicately during the placement of the implants (Fig 2). After the implants were placed (Fig 3), the bone window was filled with crushed bone (the bone removed to form the window initially), filling the space between implants and the entire bone window space. Whether the amount of bone was not sufficient, Bio-Oss was used to complete buffering the fenestration. After the cavity was filled with bone, mono-nylon 5-0 was used for interrupted and continuous mattress sutures.

During postoperative follow-up, the patients were administered 875 mg amoxicillin every 12 hours for 7 days, 100 mg nimesulide every 12 hours for 3 days, 500 mg metamizole every 6 hours or 30 mg co-co-damol while pain persisted, and one tablet of 5,000 IU pyridoxine hydrochloride a day for 60 days. The patients received instructions not to wear their dentures during all the pre-rehabilitation time.

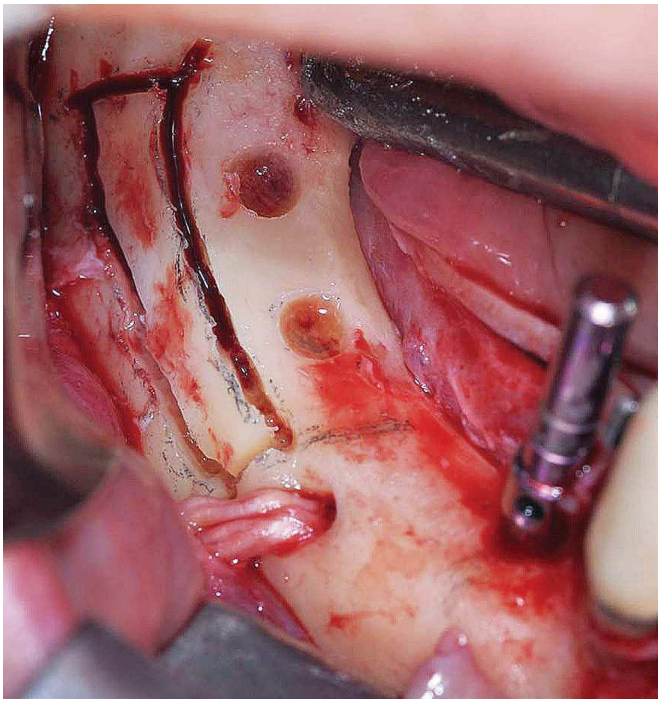

Figure 1 - Intraoperative photo taken after bone crest leveling, definition of implant position using round diamond point, and osteotomy of buccal wall.

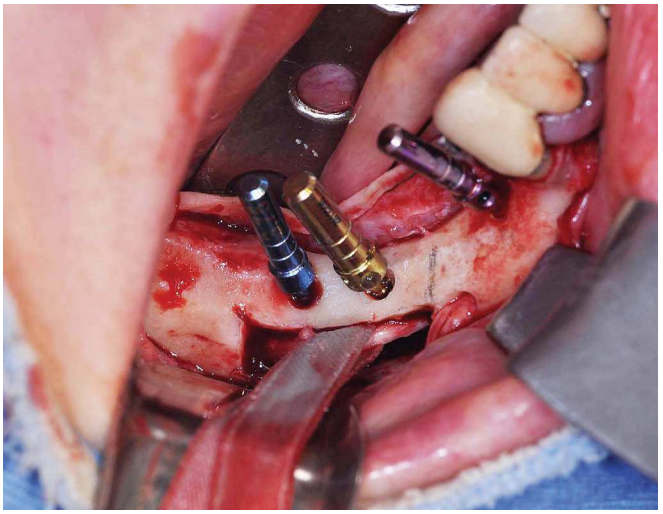

Figure 2 - Band retracting inferior alveolar nerve.

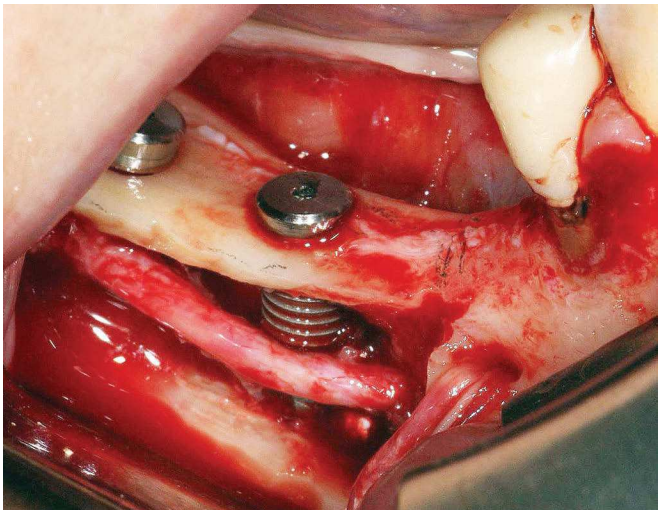

Figure 3 - After inferior alveolar nerve lateralization, implants delicately placed into bone cavity (not the same case as in Figures 1 and 2).

Evaluation method

A questionnaire was designed to register possible sensory changes and everyday life changes due to surgery, and the patient satisfaction after the procedure.

Implants were exposed 6 months after surgery. At that time, the questionnaire was handed to patients to measure postoperative sequelae. Data were analyzed using descriptive methods.

Results

Twenty men and women aged 42 to 75 years (mean age: 49 years) were included in the study, and 52 implants were immediately placed (Table 1). All patients reported initial sensory disturbances in the mental region as a result of surgery.

The shortest time to improvement was three days, and mean overall improvement was recorded at 45 days after surgery.

Of the 20 patients, only a 42-year-old woman reported still feeling neurosensory disturbances at the time the questionnaire was answered. She sometimes felt her lip, but not at other times. She also reported a gradual improvement of sensibility. Despite that, she would recommend the technique even if sensibility did not return to normal.

No patient reported interferences with daily activities or social life.

No patient reported irritability, accidentally biting their lips, pain or reduced salivation.

Table 1 - Sample of implants placed using the IANL technique.

Patients	Age	Placed implants	Implant failures
Case 1	48	3	0
Case 2	44	3	0
Case 3	47	3	0
Case 4	42	2	0
Case 5	60	3	0
Case 6	44	2	0
Case 7	43	2	1
Case 8	59	3	0
Case 9	45	3	0
Case 10	42	2	0
Case 11	75	3	0
Case 12	43	2	0
Case 13	47	3	0
Case 14	51	2	0
Case 15	55	3	2
Case 16	51	2	0
Case 17	46	2	0
Case 18	52	3	0
Case 19	47	3	0
Case 20	43	3	0

A total of 52 implants was placed, and osseointegration was not achieved in 3 of them, which were replaced without any new IANL.

All patients answered that they would undergo the procedure again, if necessary, and would recommend the treatment to others.

Discussion

Advances in dentistry have made the use of osseointegrated implant an established method to restore esthetics and function when patients lose teeth.

The posterior region of the mandible has the lowest success rates in Implantology, usually due to the unfavorable "implant-to-prosthesis" rate, monocortical implant anchorage and low bone quality.[2,5,8,9,13]

Despite the short evaluation time, the rate of success achieved in the present study was 94%, similar to the rate for conventional implants, and greater than the rate for implants in areas of onlay bone grafts.[17,18,19] This rate is very satisfactory taking into account the complexity of the cases treated.

The recommended alternatives for atrophic mandibles are: vertical bone grafts; guided bone regeneration; osteogenic distraction; horizontal osteotomy with interposition bone grafting; implant placement lateral to the nerve; and transposition or lateralization of inferior alveolar nerve.[1-4]

When other techniques are compared to IANL, their disadvantages are the need of a second operation for implant placement, the need of a graft donor site, the risk of resorption, the greater risk of dehiscence due to exposure and infection, and the need of a distance of at least 5 mm between the bone crest and the IAN.[3,11]

The surgical procedure described here involves transient or permanent neurosensory disturbances, experienced at different degrees by all the patients that undergo IANL,[1-7,11-16,20,21] as observed in our study. These disturbances are the result of direct IAN manipulation.

However, as demonstrated in the literature, as long as the patient is aware of the sequelae of this technique, dissatisfaction may be avoided.[1,4] Our study showed that, although there were sensory changes, all patients would undergo this surgery again, if necessary, or would recommend it to someone else. This indicates that the esthetic and functional benefits from this technique were more important than the sensory disturbances experienced. These disturbances seem to have a low impact on everyday life, as no patient reported changes in their daily activities after surgery.

IAN manipulation to place osseointegrated implants may be performed using two techniques: IANL, without involvement of the mental foramen, and IAN transposition, with mental foramen involvement. However, the lateralization technique has proven to be more conservative and result in fewer sequelae to the nervous bundle.[9,22]

This study did not use a membrane between the implant and the IAN. Studies in the literature do not show any consensus about the use of a barrier to protect the nerve and avoid sensory lesions.[7,22,23]

The IANL surgery may be performed in an outpatient environment with local anesthesia and conscious sedation.[3,14,22] However, this surgery also has indications of performance under general anesthesia.[3,20] Although some authors suggest the need of general anesthesia, implant placement is easier when the patient receives only local anesthesia.

When IANL is chosen, implants with more favorable length may be used in cases in which posterior mandible

resorption would force the use of shorter implants. Therefore, it provides longer longevity to rehabilitation.[3,6,24,25]

Although several treatments are available to improve IAN recovery, our patients did not undergo any treatment to accelerate neurosensory recovery besides the administration of 5,000 IU pyridoxine hydrochloride once a day for 60 days. Some authors have used laser therapy as an adjuvant therapy for neurosensory recovery, but no significant differences were found in time to neurosensory improvement when compared with our studies.[26,27]

Regardless of the technique used, the most important factor is the correct indication for each case, considering anatomy and site of defect, the patient's systemic health and, finally, costs and benefits to achieve esthetic and functional goals and restore patient quality of life.[7]

In this study, 95% of the patients recovered sensory functions in up to 6 months, which is in agreement with other findings in the literature.[1,2,4,5,7,11-16,20,21]

Conclusion

IANL is a useful technique for the rehabilitation of atrophic posterior mandibles in patients that still have their anterior teeth.

The risk of permanent mental nerve dysfunction seems to be small. Rehabilitation was achieved for all patients, without complications.

REFERENCES

1. Friberg B, Ivanoff CJ, Lekholm U. Inferior alveolar nerve transposition in combination with Branemark implant treatment. Int J Periodontics Restorative Dent. 1992;12(6):141-9.
2. Proussaefs P. Vertical alveolar ridge augmentation prior to inferior alveolar nerve repositioning: a patient report. Int J Oral Maxillofac Implants. 2005;20(2):296-300.
3. Chiapasco M, Romeo E. Reabilitação oral com prótese implantossuportada para casos complexos. São Paulo: Ed. Santos; 2007.
4. Vasconcelos JA, Ávila GB, Ribeiro JC, Dias SC, Pereira LJ. Inferior alveolar nerve transposition with involvement of the mental foramen for implant placement. Med Oral Patol Cir Bucal. 2008;13(11):722-5.
5. Silva AC, Trivellato AE, Mazzonetto R, Moreira RWF, Moraes M. Osteotomia segmentar da mandíbula com lateralização do nervo alveolar inferior para restabelecer o adequado espaço entre os arcos dentários. ROBRAC. 1999;8(26):39-42.
6. Misch CE. Implantes dentais contemporâneos. 3ª ed. Rio de Janeiro: Elsevier; 2008.
7. Rosenquist B. Implant placement in combination with nerve transposition: experiences with the first 100 cases. Int J Oral Maxillofac Implants. 1994;9(5):522-31.
8. Rudolf MSB, Hienz S, Solar P, Matejka MH, Ulm CW. Quantification off bone resorption in the foramidal region off the atrophic mandible. Int J Oral Maxillofac Implants. 2007;22(4):609-15.
9. Kan JY, Lozada JL, Goodacre CJ, Davis WH, Hanisch O. Endosseous implant placement in conjunction with inferior alveolar nerve transposition: an evaluation of neurosensory disturbance. Int J Oral Maxillofac Implants. 1997;12(4):463-71.
10. Allhassani A, Alghamdi AST. Inferior alveolar nerve injury in implant dentistry: diagnosis, causes, prevention and management. J Oral Implantol. 2010;36(5):401-7.
11. Garcia Junior IR, Magro Filho O, Cardoso LC, Rodrigues TS. Vestibularização da estrutura neurovascular para colocação de implantes dentais. Innov Implant J. 2006;1(1):71-4.

12. Rigato JL. Reposicionamento do nervo alveolar inferior em implantes dentários. Rev Bras Cir Implantod. 2000;7(28):45-8.
13. Luna AH, Passeri LA, Moraes M, Moreira RW. Endosseous implant placement in conjunction with inferior alveolar nerve transposition: a report of an unusual complication and surgical management. Int J Oral Maxillofac Implants. 2008;23(1):133-6.
14. Peleg M, Mazor Z, Chaushu G, Garg AK. Lateralization of the inferior alveolar nerve with simultaneous implant placement: a modified technique. Int J Oral Maxillofac Implants. 2002;7(101):1-6.
15. Nocini PF, Santis D, Fracasso E, Zanette G. Clinical and electrophysiological assessment of inferior alveolar nerve function after lateral nerve transposition. Clin Oral Implants Res. 1999;10(2):120-30.
16. Di Pillo LD, Rapoport A. Importância da lateralização do nervo alveolar inferior para os implantes mandibulares. Rev Bras Cir Cabeça Pescoço 2009;38(3):166-70.
17. Jones JD, Lupori J, Van Sickels JE, Gardner W. A 5-year comparison of hydroxyapatite-coated titanium plasma-sprayed and titanium plasma-sprayed cylinder dental implants. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1999;87(6):649-52.
18. Aghaloo TL, Moy PK. Which hard tissue augmentation techniques are the most successful in furnishing bony support for implant placement? Int J Oral Maxillofac Implants. 2007;22:49-70.
19. Friberg B, Raghoebar GM, Grunert I, Hobkirk JA, Tepper G. A 5- year prospective multicenter study on 1-stage smooth-surface Branemark system implants with early loading in edentulous mandibles. Int J Oral Maxillofac Implants. 2008;23(3):481-6.
20. Morrison A, Chiarot M, Kirby S. Mental nerve function after inferior alveolar nerve transposition for placement of dental implants. J Can Dent Assoc. 2002;68(1):46-50.
21. Yoshimoto M, König B, Coelho PG, Allegrini S, Luiz FFM. A light and scanning electron microscopy study of bone healing following inferior alveolar nerve lateralization: an experimental study in rabbits. Int J Oral Maxillofac Implants. 2008;23(3):457-62.
22. Jensen O, Nock D. Inferior alveolar nerve repositioning in conjunction with placement of osseointegrated implants: a case report. Oral Surg Oral Med Oral Pathol. 1987;63(3):263-8.
23. Toledo Filho JL, Marzola C, Toro ILWS, Toledo Neto JL. Transposição do plexo nervoso alveolar inferior para fixação de implantes. Rev Odontol Acad Tirad Odontol. 2005;5(7):784-97.
24. Yoshimoto M, Allegrini Junior S, Oshiro M, Teixeira V. Lateralização do nervo alveolar inferior em implantodontia: relato clínico. J Bras Clin Odontol Integr. 1999;3(17):53-7.
25. Block MS, Achong R. Bone morphogenetic protein for sinus augmentation. Atlas Oral Maxillofac Surg Clin North Am. 2006;14(1):99-105.
26. Ozen T, Orhan K, Gorur I, Ozturk A. Efficacy of low level laser therapy on neurosensory recovery after injury to the inferior alveolar nerve. Head Face Med. 2006;2(3):1-9.
27. Yoshimoto M, Sakita G, Pazos GMA, Salles MB, Maluf PSZ, Magalhães JCA. Uma nova proposta de reversão da parestesia em lateralização de nervo alveolar inferior. ImplantNews. 2008;5(6):619-25.