



**NEUROSENSORY COMPLICATIONS AND IMPLANT SURVIVAL FOLLOWING
INFERIOR ALVEOLAR NERVE LATERALIZATION AND TRANSPOSITION: A
REVIEW STUDY**

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ABSTRACT

Objective: The main aim of this review article was to consolidate the presently obtainable literature associated with the surgical techniques of lateralization and transposition of inferior alveolar nerve as a method for implant insertion in patients with moderate to severe atrophy of posterior mandibular bone. **Materials:** Nine articles regarding neuro-sensory complications and implant success rate after inferior alveolar nerve transposition and inferior alveolar nerve lateralization procedures were designated. In total, 374 adult patients between 20-78 years of age were included. **Results:** Data from nine studies was included. Two articles covered both inferior alveolar nerve transposition and lateralization, six articles included inferior alveolar nerve transposition and one article enclosed CATT (cortical autogenous tenting technique) along with inferior alveolar nerve transposition. **Conclusion:** With the exception of insertion of shorter implants, augmentation techniques with bone grafting, the lateralization and transposition of inferior alveolar nerve can prove to be an effective methodology for putting implants in patients with minimal residual bone higher to the infra-maxillary canal. With wise patient choice criteria and effective execution of the surgical procedure, this approach shows high success rate.

KEYWORDS: Inferior alveolar nerve transpositioning; alveolar bone atrophy; neurosensory dysfunction; dental implants; paresthesia.

INTRODUCTION

Introduction of implants as a substitute for natural teeth, has provided a boom to the sphere of dental speciality. They are used very ordinarily in both partially and completely edentulous patients. Rehabilitation of edentulous posterior mandibular regions with advanced ridge atrophy using implants has anatomical, surgical and biological issues.^[1] Use of long fixtures create a major risk of impinging the inferior alveolar nerve.

Other treatment choices comprise of the utilization of short fixtures (usually 10mm or less), bone grafting and augmentation or hoping on enhanced imaging studies to accurately position the implant aboard, while not trespassing the mandibular canal.^[2] The main disadvantage of grafting procedure is that it creates a supplementary traumatic site, in order to obtain a bone graft.^[2]

Another existing answer is lateral mobilization of inferior alveolar nerve. Two main techniques in use are :- transposition and lateralization. Transposition is the process including the lateral mobilization of inferior alveolar nerve through mandibular corticotomy, distal to

insertion of furthest implant planned. Incisive neurovascular bundle is transected. Inferior alveolar nerve lateralization involves lateral reflection of the inferior alveolar nerve with preservation of incisive nerve along with emergence of inferior alveolar nerve through mental foramen.^[3]

The main aim of this article is to analyse the benefits, the disadvantages, possible neurosensory complications and implant success rate with inferior alveolar nerve repositioning techniques.

History

In 1977, Alling^[4] was the first one to report inferior alveolar nerve repositioning case. Later, in 1987, Jensen and Nock^[5] documented inferior alveolar nerve transposition technique for putting implants in posterior mandibular area. In 1992, Rosenquist^[6] reported 10 inferior alveolar nerve transposition operations with placement of 26 implants. After an interval of 6 months, 20% of areas had persistent neural dysfunction. At 1 year, all the 10 sites tested usual. In 1994, Jensen et al^[7] performed inferior alveolar nerve transposition at nine sites.

After 6 months follow up, seven areas tested normal. However, one site was paresthetic and one site was hypoesthetic. In 1995, a comprehensive evaluation of 24 mandibular sites which had undergone inferior alveolar nerve transposition operation revealed that with objective neural testing, 3 sites were abnormal (12.5%), whereas with subjective assessment retrieval rate was 100%.^[1] In 2002, Morrison et al^[8] executed 26 inferior alveolar nerve transposition cases. At approximately 1month, all patients had remodeled sensation. Four patients reported permanent change in sensation.

Current surgical techniques

Pre-operatively, for accurate assessment of inferior alveolar nerve, diagnostic systems like panoramic radiograph, a computed tomography (CT) scan, diagnostic wax-up, casts and surgical templates play an important role.^[9] Before proceeding ahead with execution of the surgical techniques, its crucial to inform the patients about the possible probability of future neurosensory complications associated with these procedures. This will aid the patients to make an informed choice.

An initial crestal incision is made. Following it, anterior and posterior releasing incisions are given and a labial mucoperiosteal flap is reflected. For a better display of the surgical field, dissection is performed below the neurovascular bundle, where it departs the mental foramen.^[10]

Inferior alveolar nerve transposition

This procedure is more ordinarily used than inferior alveolar nerve lateralization. In this technique, mandibular corticotomy is performed encircling the mental foramen, prolonging anteriorly and inferiorly to prevent any damage to the loop of the nerve.^[11] A curette is plunged into the canal. It is positioned amid the bone and the nerve, in order to safeguard the nerve.^[11]

A small round bur is employed for bone cutting. In order to mobilize the inferior alveolar nerve wholly, the incisal branch, stationed at 5mm from mental foramen is resected.^[9]

Finally, implants can be placed in direct sight with bicortical engagement, which provides a good initial

steadiness. The detached bone is used as a bone graft to fill the hollowed portion and now, the mental foramen has deviated in a more posterior direction.

Inferior alveolar nerve lateralization

In this technique, lateral reflection of nerve is done through a cortical bone window, which doesn't include the mental foramen. Careful bone removal with constant irrigation is performed. Special curettes are used to liberate the neurovascular bundle.^[9] After careful freeing of the nerve from the canal, the nerve is segregated with the help of a vessel loop.^[12] A gentle lateral pull helps in smooth implant placement with marginal possibilities of impinging the inferior alveolar nerve.

A number of factors govern the selection of the suitable technique for a patient. According to Lorean et al study^[13] stretching the nerve by 10-17% of its original length might cause internal disintegration of the neural fibres. Thus, in situations demanding small strain, lateralization is preferred. Whereas, inferior alveolar nerve transposition is considered when larger stretching is required.^[9]

Assessment of neural disturbance

After the incorporation of implants, patients were recalled to gauge the recovery of mental nerve between 6 months to 105 months. According to Hirsch and Branemark,^[1] neural dysfunction results from the diminished metabolic supply, because of disturbance in neural microvascular flow as a repercussion of mechanical trauma.

Different studies used different criterions for evaluating neural dysfunction. Some of the most usual evaluation tests are being listed here. In one study, relative objective assessment of mental nerve paralysis was done with the help of modified SW perception test.^[14] This test was given by Semmes and Weinstein.^[15,16] It involved the usage of nylon monofilaments of alike length but distinct diameter (0.165, 0.215 and 0.315mm). Three sites - labial commissure, lower lip and mental region were assessed.

Hight criteria^[17] is helpful in qualitative analysis of neural disturbance [See Table1].

Table 1: Hight grading.

Stage 0	Complete loss of sensation
Stage 1	Advent of deep discomfort
Stage 2	Some degree of tactile retrieval and pain on skin surface
Stage 2+	Emergence of hyperalgesia and complete kinesthetic recovery and pain
Stage 3	Recovery of tactile sensation without pain; vanishing hyperalgesia
Stage 3+	Restoration of position sense, to some magnitude, with 2-point discrimination (2PD: 6-15 mm)
Stage 4	Total sensory recovery (2PD: 2-6 mm)

Two-point discrimination test can also be brought into use. It is performed in lower lip/chin and a

discrimination of more than 14mm on the instruments is regarded as unusual.^[18] Opposite side in unilateral cases

and infra-orbital/ upper lip areas for bilateral cases are used as controls.^[18]

Cotton- touch technique and pin-prick test can also facilitate detection of hypoesthesia, anaesthesia and hyperesthesia.^[2]

Piezosurgery

Apart from the conventional method of using bur for bone cutting, recently piezosurgery came into picture. This device uses microvibrations with fluctuations of 20-200 µm,

That cut solely the mineralized tissue. When the device comes into touch with non- mineralized tissue, its action ceases, thereby preventing any sort of harm to the nerve.^[19] Although there is a disadvantage too, that it takes considerably longer duration.^[20]

Advantages and Disadvantages of inferior alveolar nerve repositioning

Inferior alveolar nerve transposition and lateralization techniques have several advantages. Firstly, longer implants can be placed without encroaching on the nerve. Ability of bicortical engagement provides good primary steadiness. It diminishes the necessity of additional radiation- intensive and overpriced imaging studies as

only panoramic radiography and clinical examination are enough.^[11] Placement of implants during the surgical procedures turns down the overall treatment duration.^[9]

One major disadvantage of these techniques is the inability to recover the initial alveolar ridge contour.^[21] Moreover, some literature supports the multiplied risk of inframaxillary fracture with inferior alveolar nerve repositioning .Also, the clinicians prefer general anaesthesia for the patients undergoing this technique due to various reasons. This general anaesthetic management of myotonic dystrophic patients can pose a difficulty, therefore it is also a negative point.^[22] Additionally, it can also sometimes become a causal issue for osteomyelitis.

RESULTS

During the short listing process, a total of 9 articles were selected randomly which provided information in alignment with the objective of our review article. A total of 374 patients were evaluated after they had undergone either of the inferior alveolar nerve repositioning procedures. Females constituted 64.9% of the total patient count, while males were 35.1%.The age limit ranged from 20-78years.The follow up period extended from 6 months to 105 months (average 37.19months).

List of the study articles that were included are

Study	Year of publication	Patient count	Technique used
J.M. Castellano- Navarro et al ^[3]	2019	123	IAN Lateralization and IAN Transposition
Lorean et al ^[23]	2013	57	IAN Lateralization and IAN Transposition
Al-Almaie et al ^[24]	2020	8	IAN Transposition
Nishimaki et al ^[14]	2016	6	IAN Transposition
Arash Khojasteh et al ^[25]	2016	118	CATT and IAN Transposition
M Hori et al ^[2]	2001	6	IAN Transposition
Jensen, Reiche- Fischel and Sindet- pederson ^[26]	1994	6	IAN Transposition (modified)
Giulio Gasparini et al ^[27]	2014	35	IAN Transposition
Bruno Ramos Chrcanovic et al ^[11]	2009	15	IAN Transposition

[Abbreviations: IAN – Inferior Alveolar Nerve]

Individual Results

In first study article,^[3] neural issues were detected after the procedure. Out of 123 sites,7 showed no disablement of function of the nerve;34 improved after one month,72 recovered after 6 months and 26 healed after one year.

In second study,^[23] one implant loss was there during the check up period. No permanent neural disturbance was perceived. Only 4 patients showed prolonged transitory neural issues right after the procedure.

In third article,^[24] cumulative implant survival was 100%.Neurosensory complications were seen in 2 out of 10 sites. Out of 10 sites, 4 sites healed immediately while

3 within one month, 2 after 6 months and 1 after 12 months.

In 4th article,^[14] no implant loss seen during follow up. Absolute neural recovery was seen at 2 sides, weak hypoesthesia on 2 sides, moderate hypoesthesia on 2 sides, severe hypoesthesia at one side. There was just one patient who had concern regarding inferior alveolar nerve operationing.

In 5th study,^[25] gross survival and success rates in CATT group were 98.73% and 71.52%,while in IAN transposition group were 98.74% and 94.56%. Two cases of neural complications in CATT group, while 7 cases

with permanent neural issues in IANT group. Two implant failures each were seen in both classes. One inframaxillary fracture was discerned in IANT group.

In sixth article,^[2] after three years, implant longevity rate was 100%(approximately).One patient recovered totally from neural disturbances after 3years, 5 still experienced some numbness, although it was not a big concern to any.

In 7th article,^[26] all implants revealed good outcomes during follow up. No mobility, pain or bone loss was observed. After 6 months, all patients had usual neurosensory function, excluding 2 patients. One of them still had objective neural problems after 12 months.

In 8th article,^[27] neural complications were perceived in 6 cases out of 35 patients. One case presented transitory anaesthesia, five cases of transient hypoesthesia (that resolved spontaneously after 6 months).No cases of paresthesia were noticed.

9th article,^[11] presented amazing outcomes. Although initial paresthesia was seen in all cases, but absolute recovery of neural disturbances seen within a duration of 6 months. Three out of 25 dental implants, did not integrate.

Limitations

The main drawback of this review article is the limited number of studies taken into consideration. Also, the selection was done in a random manner instead of a more systematic approach.

CONCLUSION

It is quite evident that there are two main approaches for repositioning of inferior alveolar nerve. One is inferior alveolar nerve lateralization and other is inferior alveolar nerve transposition. Both techniques have certain pros and cons. Neurosensory complications are one of the biggest concern while attempting this procedure. However, it is seen that solely few patients experience permanent neural problems, while majority of them recover within a given span of time. The implant success after the surgical procedure is also very good. At certain times, this is the only possible treatment preference available, taking under consideration the entanglement of providing the fixed prosthesis in edentulous atrophic posterior mandible. Thus with proper treatment planning and execution, these surgical techniques supply good results.

CONFLICTS OF INTERESTS

The authors declare that they have no conflict of interest related to this study.

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