

Lateralization of the inferior alveolar nerve

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_Depending on the anatomical situation, the lateralization of the inferior alveolar nerve may be one, or perhaps the only, solution to manufacture a fixed prosthesis for a patient with a free-end situation. This article describes the surgical technique used to minimize probable risks.

_Problems

If a patient with conservable residual dentition in the anterior mandibular area with a free-end situation requires an implant-supported restoration, problems may arise regarding the route of the inferior alveolar nerve. If the route of the nerve runs too far toward the crestal bone, or if there are already signs of atrophy in the crestal part of the jaw, a restoration with a common implant may be difficult, or even impossible. Here are several solutions for this problem.

One solution is the use of short implants (< 10 mm). The minimum length of common implant systems is 7–9 mm. Therefore, the bottom line for a conventional implant should be calculated with a safety margin of 2 mm, provided that there are approximately 9–11 mm of crestal bone. As observed in the mandible, the survival rates of 8 mm long implants

are similar to the survival rates of longer implants (Grant⁵ 2009).

Another alternative is a vertical augmentation with autologous bone or allogenic materials. With respect to resorption, the long-term prognosis is controversial. Schlegel¹³ states a resorption rate of approximately 30 % after five years. Moreover, this solution must be excluded for those cases in which atrophy of the jaw bone is not due to insufficient crestal bone, but to the crestal route of the inferior alveolar nerve (Fig. 1). This method requires the usage of pelvic bone, which implies a second surgery site. Probable rates of long-term complaints in this area are partially stated as 11 % (Cricchio¹ 2003).

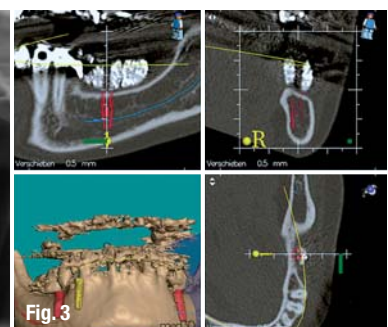
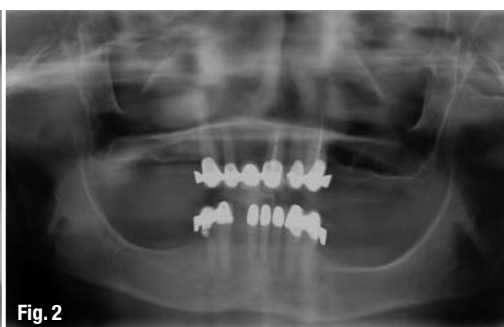
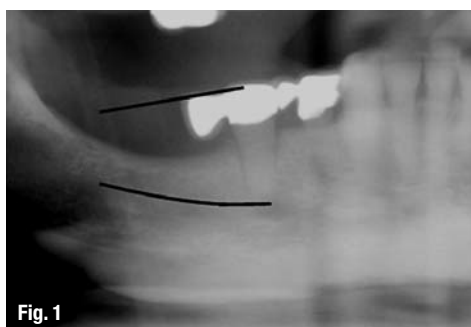
Another option is the osteodistraction in the lateral mandibular area. In order to place the distractor cranially to the nerve canal, a minimum of 8 mm residual bone substance is necessary for the application of this technique. Here, the resorption rate is lower than in cases of vertical augmentation (Esposito² 2009).

Thus, the lateralization of the inferior alveolar nerve facilitates implantation in the lateral

Fig.1 _Crestal route of the inferior alveolar nerve.

Fig. 2 _OPG before surgery.

Fig. 3 _Evaluation with Med 3-D software.





mandibular tooth area. There are two operative approaches cited in literature that suggest how to change the route of the nerve, and how to make implantation possible. This article describes a technique which minimizes risks thanks to exact planning and by using Piezo surgery.

Surgical techniques

In 1987, Jensen⁸ and Nock were the first to publish this technique developed for the translocation of the mental foramen.

The technique shows the exit of the inferior alveolar nerve at the mental foramen. Being observed and taking care of the nerve, the foramen is extended into distal direction, thus the nerve's exit from the jaw is further distal and in the buccal direction.

This allows implantation in position 5 and/or 6 without damaging the nerve. Kan, Pelg and Ferrigno describe another surgical technique for the lateralization of the nerve, distal to the mental foramen. With this technique the inferior alveolar nerve stays intact in the area of the mental foramen. The technique is described in detail in this article. The fenestration of the compact bone was carried out distal to the foramen. The route of the nerve is visualized and the nerve lateralized. The optically controlled implant insertion is carried out leaving the nerve aside. After insertion the nerve will be put back into the bony window.

Risks and complications

This technique carries the important risk of temporary or even permanent irritation of the nerve, which may lead to anesthesia, hypesthesia

Fig. 4_Clinical initial situation.

Figs. 5 & 6_Preparation of the buccal bony window with the cogged part of the Piezo device.

		Surgeries	Technique	Implants	Sensoric disorders	Survival rate
Rosenquist ¹²	1992	10		26	0 % 12 M	96 %
Jensen ⁷	1994	10	Displacement of the foramen	21	10 % 12 M 50 % 3 M	100 %
Kan ⁶	1997	9 12	Displ.of foramen translocation	29 35	66,7 % 10–67 M 33,3 % 10–67 M	93,8 %
Pelg ¹⁰	2002	10	Translocation	23	10 % 6W no permanent disorders	100 %
Ferrigno ³	2005	19	Translocation	46	10 % 12 M	96 %

Tab. 1_A variety of studies concerning the lateralization of nerves.

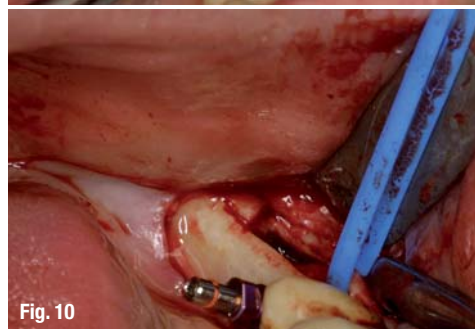
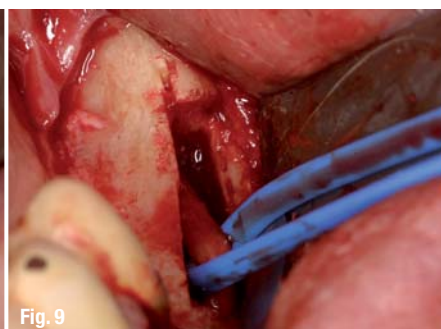


Fig. 7_Preparation of the buccal bony window with the coggled part of the Piezo device.

Fig. 8_Preparation of the nerve.

Fig. 9_The encircled nerve.

Fig. 10_Post-implantation status.

Fig. 11_Repositioning of the nerve.

Fig. 12_Covering with a collagen membrane.

or paresthesia. Several studies have considered this risk.

In his 1992 study Rosenquist¹² demonstrated that 12 months later sensory disorders could not be observed in all 10 patients (26 implantations). Peleg's¹⁰ 2002 study did not show any permanent disorders either. Jensen⁷ quoted 10 % sensory disorders after 12 months. In 2005 Ferrigno³ reached the same results, and he also agreed with the figure stated by Watzek¹⁴. The interesting retrospective study by Kan⁹ 1997 is the only one that compares both surgical techniques, the "displacement of the foramen" and the "lateralization of the inferior alveolar nerve". He analyzed 21 surgeries (64 implantations) after 10 to 67 months. He found out that sensory disorders occurred significantly more often in cases of displacement of the foramen (66.7 %) compared to the lateralization of the nerve (33.3 %).

Fig. 13_Status following prosthetic restoration.

Fig. 14_X-ray control.

These results show that in this regard, lateralization is less risky. The implant survival rate stated

in the above-mentioned studies is between 93.8 % and 100 %. Kan describes for example another probable complication, i.e. a fracture of the mandible at the operation site. The mandible is weakened by the removal of the buccal corticalis, and by the crestal implantation at the same time, and thus there is an increased risk of fracture.

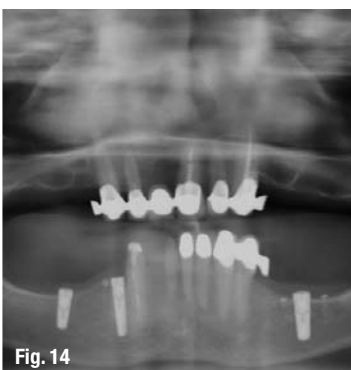
We observed temporary irritations of the mental nerve appearing as paresthesia in 90 % of our own patients. These irritations disappeared completely within 8 weeks.

Clinical procedures

Diagnosis

Thorough clinical and radiological examinations are crucial preparations for this surgical procedure. In addition to the conventional OPG (panoramic radiography) (Fig. 2), a three-dimensional examination using CT (computer tomography) or DVT (digital volume tomography) images, and their evaluation with the appropriate software, is absolutely necessary. Therefore it is possible beforehand to get a three-dimensional image of the route of the inferior alveolar nerve in the mandible. Figure 3 shows an evaluation using Med-3-D software.

The positioning of the buccal bony window should be especially considered when planning the surgery. After having prepared the buccal bony window and the implant cavity, it is of great importance to preserve enough bone in the buccal area of the implant, in order to guarantee sufficient primary stability.



Operative procedures

After carrying out an insertion of the jaw ridge and the preparation of the mucoperiosteal flap, the mental foramen can be shown. This is important and enables orientation when positioning the lateral bone incision. The horizontal incision line starts approximately 3–5 mm distal of the foramen. The incision depth depends on the route of the inferior alveolar nerve distal from the foramen. Piezo surgery is recommended for the preparation of the bone incision and the latter preparation of the inferior alveolar nerve because it guarantees maximum safety for the soft tissue, while at the same time the risk of nerve irritation can also be reduced. After the removal of the buccal corticalis the nerve can be prepared in the cancellous bone. Usage of the diamond-coated part of the Piezo device is recommended for this procedure. After preparation, the nerve will be encircled with ethiloo silicone sling^a.

The preparation of the nerve is followed by the insertion of the implant. In order to obtain sufficient primary stability, there must still remain enough bone in the buccal area after the preparation of the cavity. If there is not enough bone left, the buccal bone lamella may break during insertion, which might endanger the primary stability of the implant. The preparation of the counter corticalis is also suggested, provided that the implant is long enough. A previously manufactured—by means of 3-D diagnosis—orientation template, can be used for the bucco-lingual and mesio-distal positioning of the implant.

The nerve can be repositioned directly on the implant (in this case a CAMLOG Srewline, 4,3 x 13 mm, was used, Fig. 10 and 11) without taking any further measures. Some authors (Rosenquist¹¹, Friberg⁴) state that the contact with sharp thread edges often causes chronic irritation. Use of implants with a low incisive thread is therefore recommended in order to avoid nerve irritation. After repositioning the nerve the bone cavity will be filled with bone chips, which were obtained by grinding the buccal compact bone. Afterwards, the cavity will be covered with the collagen membrane^b, which will be fixed with membrane nails^c. The wound is carefully closed with successive single interrupted sutures^d. After a waiting period of three months, the fixed prosthetic restoration can

be done. During this time the operative site should not be irritated.

_Discussion

The lateralization of the inferior alveolar nerve offers patients the possibility of obtaining a fixed prosthesis in the mandible, provided that they have a conservable anterior residual dentition and a free-end situation.

This is sometimes the only feasible procedure to help patients obtain a fixed prosthesis, especially in those cases where there is only very little residual bone height depth left due to the route of the inferior alveolar nerve rather than atrophy. Other advantages are the fixation in the pre-existing bone, and the one site surgery, which make augmentative procedures unnecessary. This also avoids the disadvantages of other procedures for example the risk of resorption. The evaluation values for implant survival rates are similar to those for standard implantations. However, there are two reasons that might advise against a lateralization of the inferior alveolar nerve: (i) the complicated surgical technique requires a skilled surgeon and (ii) the risk of nerve irritation.

Patients have to consider 6–8 weeks of lasting paresthesia of the mental nerve, and the possibility of a permanent paresthesia cannot be excluded. It is therefore of utmost importance to inform the patient in detail beforehand. A rather rarely-occurring complication is a mandibular fracture in the area of the bony window. In 10 of the 11 lateralization surgeries carried out in the authors clinic, the function of the mental nerve was completely recovered within 6–8 weeks. In one case, one patient still suffers from permanent paresthesia, though it does not disturb much. However, even this patient would again decide upon this surgery instead of choosing a removable mandibular prosthesis as alternative solution. No case of implant loss can be reported. In all cases, the fixed implant-supported prosthesis could be manufactured according to the previous planning.

Editorial note: The literature list can be requested from the author.

^a Ethiloo—Ethicon

^b Bio-Gide—Geistlich Biomaterials

^c Frios Membrannägel—DENTSPLY Friadent

^d Ethibond Excel 4-0—Ethicon

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implants

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