Asian Journal of Modern and Ayurvedic Medical Science | ISSN 2279-0772 [ONLINE]

Volume: volume 3 number 1, | Date: Thursday, May 01, 2014

Published By Mpasvo , Article Url :
http://www.ajmams.com/viewpaper.aspx?pcode=8848a340-fd18-4726-b5c8-9fdbd2875227

PUBLISHED PAPER'S TITLE : INFERIOR ALVEOLAR NERVE REPOSITIONING FOR PLACEMENT OF DENTAL IMPLANTS IN AN ATROPHIC MANDIBLE.

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Asian Journal Of Modern And Ayurvedic Medical Science (ISSN 2279-0772), Volume: 3 Number 1 ,January-June 2014.[©The Author 2014]

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Research Paper

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INFERIOR ALVEOLAR NERVE REPOSITIONING FOR PLACEMENT OF DENTAL IMPLANTS IN AN ATROPHIC MANDIBLE.

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Declaration

The declaration of the author for publication of research paper in asian journal of modern and ayurvedic medical science (issn 2279-0772) we Mohammad Faisal1 , Chandresh Jaiswara2 , Uzma Ansari3 , the authors of the research paper entitled INFERIOR ALVEOLAR NERVE REPOSITIONING FOR PLACEMENT OF DENTAL IMPLANTS IN AN ATROPHIC MANDIBLE Declare that ,we take the responsibility of the content and material of my paper as we our self have written it and also have read the manuscript of our paper carefully. Also, we hereby give our consent to publish our paper in ajmams , this research paper is our original work and no part of it or it's similar version is published or has been sent for publication anywhere else.we authorise the editorial board of the journal to modify and edit the manuscript. We also give our consent to the publisher of ajmams to own the copyright of our research paper.

Received January 25, 2013 ; Accepted February 14 , 2014 , Published May 1,2014
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Abstract:

Prosthetic replacement with dental implants in the mandibular posterior region is often challenging due to alveolar bone atrophy. Various strategies have been employed to overcome alveolar bone deficiencies such as guided bone regeneration with allograft and alloplastic bone substitutes,onlay and sandwich bone grafts, distraction osteogenesis,all on four implant technique with a shortened dental arch,buccal or lingual positioning, use of short implants and lastly the nerve repositioning techniques. The following article is a commentary on the indications, types, technique, advantages and drawbacks of nerve repositioning procedure for placement of dental implants in a severely atrophic mandible.

Introduction:

Reconstruction and rehabilitation of the alveolus in cases with severe alveolar ridge atrophy is a challenge for maxillofacial surgeons and prosthodontists.Various strategies have been employed to overcome alveolar bone deficiencies such as 1)guided bone regeneration with allograft and alloplastic bone substitutes,2)onlay and sandwich bone grafts,3) distraction osteogenesis,4)all on four implant technique with a shortened dental arch,5)buccal or lingual positioning,6) use of short implants and 7) lastly the nerve repositioning techniques. The following article is a commentary on the indications, type's technique, advantages and drawbacks of nerve repositioning procedure for placement of dental implants in a severely atrophic mandible.

All the above mentioned procedures have their indications and inherent drawbacks. Bone regeneration with bone substitutes allays the need of a secondary procedure but in severely atrophic mandibles requiring more than 5mm residual bone the amount of bone regeneration is highly unpredictable and increases the treatment time. Autogenous bone is the gold standard but requires an additional procedure often under general anaesthesia, donor site morbidity and significantly increases the treatment time due to the time for graft uptake. Osteogenic distraction of the anterior mandibular alveolar crest has become increasingly popular in recent years and requires no graft harvesting. In some cases the technique can be performed under local anaesthesia, though strict patient cooperation and several surgical steps are required. Distraction in the atrophic posterior mandible is difficult and with limited bone is often impossible. Use of short implants and placement of angulated implants is often being used but there is a lack of data showing the long term clinical success of both implants and prosthetic rehabilitation.

Inferior alveolar nerve repositioning:

The first case of inferior alveolar nerve repositioning was published in 1977 by *Alling*[1] for prosthetic rehabilitation in patients with severe atrophy and proximity of the nerve close to the alveolar crest. However, the first case of repositioning in the context of osseointegrated implant placement was described by *Jensen and Nock*[2] in 1987, with normalization of sensory function 5 weeks after surgery. The first case series on nerve repositioning was reported by Rosenquist[3, 4] on 10 patients using 26 implants. He reported an implant survival rate of 96% for this procedure. Nerve repositioning is a young procedure that needs further refinements in terms of technique and instrumentation to decrease complications. Repositioning is performed via one of two surgical techniques, lateralization or transposition, with lateralization yielding lower degrees of nerve deficiency. In lateralization[5](fig 2), the IAN is exposed and retracted laterally, held in this position during implant placement, then released to rest against the implants. In the transposition[6] technique(fig 3) , the mental foramen is included in the osteotomy, to allow incisive branch excision, so that the IAN can be pulled into a new position which is distal to the original and often is done to allow implant placement in the second premolar and first molar region.

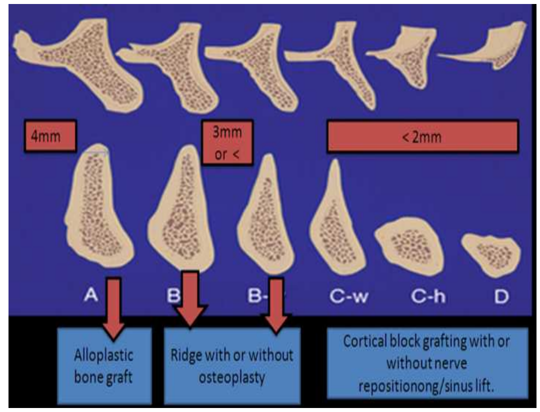

Fig 1: Bone augmentation indications.

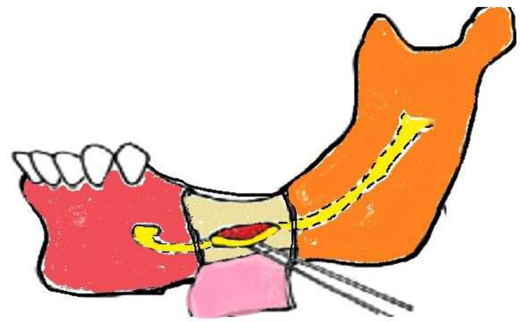
Fig 2: inferior alveolar nerve lateralization.

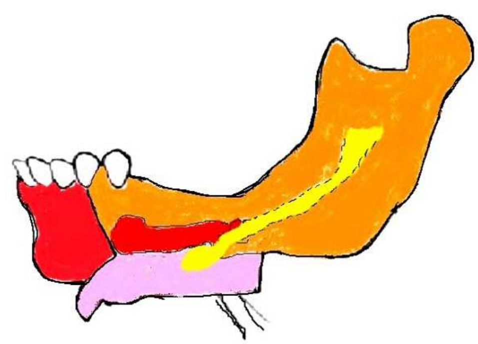
Fig 3: mental nerve transposition/ distalization.

Osseointegrated implants placed in combination with IAN repositioning present a lower risk of bone loss when compared to short implants placed in poor quality residual bone. Often these short implants have shown unpredictable periimplant crestal bone loss and their placement requires more precision to counter the occlusal forces. The technique makes it possible to place the dental implants in the same surgical step. For clinical situations with less than the minimum height for short implants (5 mm), IAN repositioning is the technique indicated (Fig 1). Repositioning of the inferior alveolar nerve offers the following advantages:

- Greater primary implant stability is afforded thanks to the possibility of bicortical mandibular fixation. Implants of greater length can be placed in the same surgical step. Both the alveolar cortex and basal bones is engaged.
- Only a physical examination and simple radiological study (e.g., CBCT and panoramic X-rays) are needed.
- Increased protection of the dental neurovascular bundle is afforded; during implant placement. The neurovascular cortex is exposed by lateral window in to the mandibular buccal cortex locating the canal on a CBCT. The nerve is retracted laterally and repositioned after the implants are placed.
- No bone grafting is needed, and donor site morbidity is avoided.
- Procedure can also be done under local anaesthesia.
- Osseointegrated implants placed in combination with IAN repositioning present a lower risk of bone loss than short implants.
- Treatment time is shortened considerably as implants are placed simultaneously.

Repositioning of the inferior alveolar nerve – disadvantages:

- Nerve repositioning is a complex procedure, requires good clinical acumen, skills and dexterity on the part of the surgeon to perform a successful surgery.
- There is a high risk of sensory disturbances anaesthesia[7], paresthesia or neuralgia, mostly of a transient nature, but sometimes permanent. In transpositioning technique the incisive nerve is excised leading to a paresthesia over the area of its supply i.e. the lower anterior teeth and mucosa.
- Risk of fracture of the mandible especially in the area of the buccal window from where the nerve is lateralised. Placement of dental implants further removes bone from the atrophied mandible making it susceptible to fracture.
- Other complications include implant loss, haemorrhage (result from transaction of the neurovascular bundle) and osteomyelitis.

Inferior alveolar nerve and its branches:

The inferior alveolar nerve is a branch of the posterior division of the mandibular branch of the trigeminal nerve. It enters the mandibular canal through the mandibular foramen located adjacent to lingula medially on the ascending ramus. It proceeds anteriorly in the mandibular canal traverses the mandible from the lingual to the buccal side[8]. In the first molar region, the nerve is midway between the buccal and lingual cortical plates where it usually divides into the mental and incisive nerves[9,10]. Traversing through the mental canal, the mental nerve and vessels continues upward and emerges from the mental foramen to supply the skin of the chin and skin and mucous membrane over the lower lip.

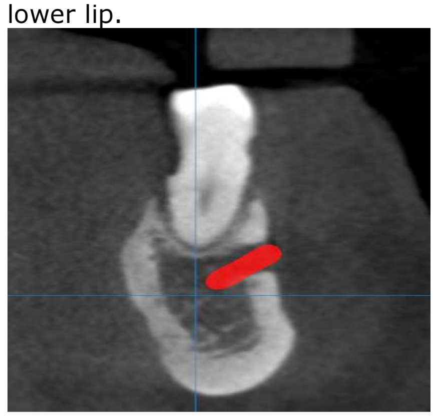

Fig 2: mental nerve as it exits from mental foramen (CBCT).

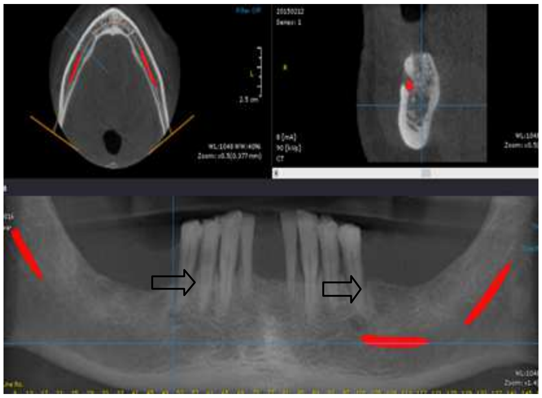

Fig 3: location of inferior alveolar canal and mental foramen (CBCT and panoramic view).

Mental foramen is usually located by the apex of the second mandibular premolar or between the apices of the premolars. Various studies have revealed variations in the position of the mental foramen both in the horizontal and vertical plane. These variations may be race related. A study by Wang et al[11](1986) on the location of mental foramen reported that the mental foramen is usually located apical to the second premolar among Chinese subjects. Another study on Caucasian subjects[12] found that it is usually found between the premolars. Few studies have reported that sometimes it can be found anteriorly by the canine or posteriorly by the first molar.

Fishel et al[13] (N = 936 full-mouth series) reported the mental foramen's location in the vertical plane (occluso-apically) for the first and second premolars. They recorded the percentage of times it was present: first premolars – 38.6% coronal to the apex, 15.4% at the apex, and 46.0% apical to the apex; second bicuspids – 24.5% coronal to the apex, 13.9% at the apex, and 61.6% apical to the apex. It can be concluded that the foramen's location is not constant in the horizontal or vertical planes. The location and emergence of the mental neurovascular is necessary as it aids in planning of the buccal window during nerve lateralization. Emergence of the mental nerve at the mental foramen may follow 1 of 3 patterns that include formation of an anterior loop (most common).It may follow the path of the inferior alveolar canal as it emerges with no anterior loop formation or thirdly it may exit perpendicular(least common) to the canal axis[14,15] . The CBCT helps to determine the mental canal curvature and mental foramen location as the nerve exits the foramen. This information is helpful in the transpositioning procedure. Cone beam computed topographic(CBCT) images are of great help to evaluate the location the inferior alveolar canal in relation to the alveolar crest Furthermore, the finding that it may be coronal to the apex of the root needs to be considered when performing immediate placement of dental implants in sockets.

Nerve repositioning technique:

Inferior alveolar nerve transpositioning for implant placement is usually performed by 2 techniques:

1. IAN repositioning without mental nerve involvement or inferior alveolar nerve lateralization: in this procedure no implant placement is required in the premolar region.

2. IAN repositioning with mental nerve transpositioning or mental nerve distalization with involvement of mental foramen: Implant placement is required in the premolar region and there is a need for transpositioning of mental neurovascular bundle and even transection of incisal nerve and transposing the nerve distally.

Anaesthesia:

IAN repositioning can be done under local anaesthesia alone, local anaesthesia along with sedation or under general anaesthesia based on the patient's condition.

Incision:

a horizontal crestal incision is made on the alveolus starting from anterior ramus to the canine region. For ease of retraction the incision can be curved buccally towards the external oblique ridge distally. The incision should extend at least 1 cm beyond the anticipated site of the osteotomy.A releasing incision is made anteriorly and towards the vestibular sulcus at the mesial surface of the mandibular canine in order to avoid injuring mental nerve branches.

Flap reflection:

a full thickness mucoperiosteal flap is reflected to completely expose the mental foramen and further dissection is extended towards the inferior border. Careful flap reflection to preserve the integrity of the periosteum and the neurovascular bundle where it exits the mental foramen and enters the soft tissue. The periosteum around the mental nerve is dissected and the nerve is skeletonised which helps in retraction and visibility.

Bone removal for nerve lateralization:

The area of bone removal is evaluated by the radiographic and CBCT details. Bone can be removed using a diamond round bur or piezosurgery device. In the lateralization technique a rectangular window is made into the buccal cortex. A vertical osteotomy, approximately 10 to 15 mm in length, is made 5 mm posterior to the mental foramen keeping in mind the length of the mental canal (CBCT guided) and follows the inferior alveolar canal path posteriorly and superiorly. Using a no. 4 round bur bone or a piezosurgery device cut is made only through the outer cortex. The posterior osteotomy should extend 5 to 10mm posteriorly beyond the intended position of the most distal implant. This allows for passive positioning of the neurovascular bundle after implant placement. Horizontal osteotomies connect the vertical bone cuts. Care is taken to assure that the bone cuts are made through the cortical bone and just into the softer and bleeding cancellous bone. Small curved osteotome is malleted to complete the rectangular osteotomy. Lever action against the mandible then removes the entire outer rectangular cortical window, which is discarded. Medullary bone lateral to the neurovascular bundle is removed using small blunt curettes along with all sharp edges of bone along the window that could lacerate the neurovascular bundle. The neurovascular bundle is identified and retracted from the inferior alveolar canal using a nerve loop and small curettes. A small piece of sterile dental floss can be passed around the nerve using a curved hemostat and would aid in lateral retraction of the nerve during dental implant placement.

Bone removal for nerve transposition/ distalization:

this technique is useful when implants are to be placed in the premolar region in an atrophic mandible. The mental foramen is included in the osteotomy and warrants careful protection of the mental nerves.
With a similar incision and exposure of the mental neurovasulature an instrument such as a curette or a blunt end of a Molts periosteal elevator is placed in between the nerve and the bone in order to protect the nerve. Careful dissection of the connective tissue off the nerve trunk is done so that the foramen could be identified. The nerve trunk is mobilized sufficiently so that it can be lifted upwards to expose the underlying bone, and give adequate access. The nerve trunk in reflected in an anterio -superior direction and a surgical bur is used to cut open the posterior aspect along the mental foramen. The curvature of the mental loop is followed during bone removal distal to the mental foramen. The bone removal is extended up to 5mm distal to the most posterior implant to be placed. After removing approximately 8 mm of posterior and 7 mm caudal bone, incisive nerve was transected and the nerve trunk is mobilized. In this technique, minimum amount of bone is removed from the buccal cortex and the maximum amount of bone is preserved taking care of the nerve. The foramen is relocated in a distal position; hence the mental nerves exit distally and in the buccal direction. This allows implantation in position of premolars and molars without damaging the nerve. Another advantage of this technique is that mandibular bone weakening is less as less cortical bone is removed. It is important to document the new location of the neurovascular bundle in

the medical record in case any future surgical intervention is required

Preparing the implant placement site and implant positioning:

mucoperiosteal flap and nerve are retracted and an implant is placed. It is important that the implant length be long enough to pass the osteotomy and engage the basal bone to achieve sufficient primary stability.

Repositioning the neurovascular bundle inside the canal:

few authors recommend placement of smooth surfaced, non-screw type implants in such cases. However we prefer to place screw type implants as they afford greater primary stability. Hence we recommend placement of some bone material/graft and a barrier membrane between the nerve and the implants.

CONCLUSION

Repositioning the inferior alveolar nerve using both lateralization and transpositioning/distalization techniques make more bone that is inferior to the mandibular canal available to accommodate ideal placement and greater length of the implant. Longer implants that afford greater primary stability and early prosthetic rehabilitation are possible. Cone beam computed tomography is an effective tool that is useful in locating the inferior alveolar canal and the mental neurovasulature as in essential diagnostic tool for a surgeon undertaking nerve repositioning surgery. Surgical experience and proper preoperative treatment planning minimizes the risk of nerve paresthesia postoperatively.

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