RESEARCH

The Efficacy of Mylohyoid Nerve Anesthesia in Dental Implant Placement at the Edentulous Posterior Mandibular Ridge

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The aim of this study is to evaluate the anesthetic efficacy of mylohyoid and buccal nerve anesthesia at the posterior edentulous mandible versus regional anesthetic block to the inferior alveolar nerve in dental implant surgery. The study was composed of 2 groups. In the first group (group A), 14 voluntary adults (7 female and 7 male) received local infiltrations of 1 mL articaine HCl 4% with epinephrine 1/200 000 to the ipsilateral mylohyoid and buccal nerves. In the second group (group B, control; 9 female and 5 male adults), the inferior alveolar and the buccal nerve blocks were performed. Visual analog scales were obtained from patients to determine the level of pain during incision, drilling, implant placement, and suturing stages of implant surgery. A combination of buccal and mylohyoid nerve block offered an acceptable level of anesthesia. Two patients from group A stopped the ongoing surgery and had extraregional anesthesia by inferior alveolar nerve block. In group B, patients were operated on successfully. Local anesthetic infiltrations of the mylohyoid and the buccal nerve may be considered alternative methods of providing a convenient anesthetic state of the posterior mandibular ridge.

Key Words: mylohyoid nerve, posterior edentulous mandible, local anesthesia

INTRODUCTION

Generally, a regional anesthetic block of the inferior alveolar nerve (IAN) is used for surgical procedures confined to the mandibular posterior region.[1] However, it is known that this locoregional anesthesia technique will not always be preferred because of a relatively higher incidence of potential risks of neural and vascular injuries

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and intravascular injections; thus, the needle tip must reach the proximity of the IAN to ensure an anesthetic effect.[2–4]

As an alternative, local infiltration to the mylohyoid nerve (MN) might be preferred instead of a regional IAN block.[5,6] An appropriate MN block requires less experience and is a reliable technique considering the adjacent anatomical structures compared with the IAN block, which necessitates the insertion of the needle next to the pyterygomandibular space. Despite the fact that MN is accepted as the motor nerve innerving the mylohyoid muscle and anterior of the digastrics muscle,[7] it was shown that MN also contains sensory fibers.[8] Pulpal innervation of mandibular anterior teeth was demonstrated to be provided by MN in a few studies.[6,8–13] Accordingly, the MN advances forward and enters the mandible from the retromandibular foramen and provides sensory innervation to the lower incisors. Research is mostly directed to the pulpal innervations of the anterior mandibular teeth.[14] On the other hand, 21% anesthesia can be achieved on the mandibular posterior teeth with local infiltration to the mylohyoid region.

The aim of this study is to assess the efficacy of the MN and buccal nerve (BN) blocks instead of the regional anesthesia provided by the IAN block. The main idea was to verify the rationale of using infiltration techniques in implant surgery for the edentulous posterior mandibular region, thus diminishing the risk of anesthetic failures and side effects and at the same time impairing the risk of damage to the anatomical structures during implant insertions.

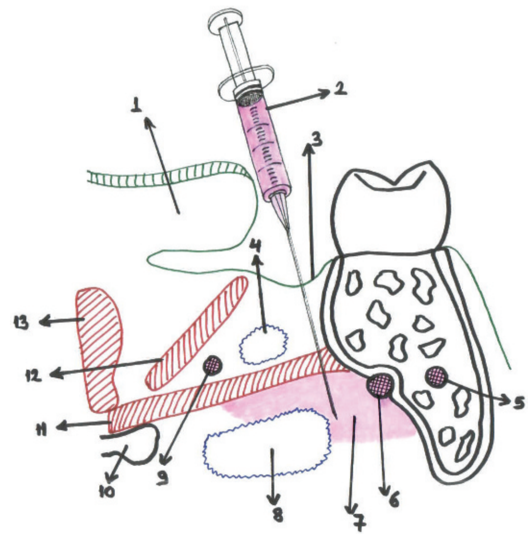

Figure. Frontal view of procedure of mylohyoid anesthesia: (1) tongue, (2) injector, (3) floor of mouth, (4) sublingual gland, (5) nerves alveolaris inferior, (6) nerves mylohyoideus, (7) injected anesthetic substance, (8) submandibuler gland, (9) nerves lingualis, (10) hyoid bone, (11) musculus mylohyoideus, (12) musculus hyoglossus, (13) musculus genioglossus.

Materials and Methods

Fourteen volunteer adult patients divided into 2 subgroups (groups A and B) participated in the study. In the first group, group A, MN anesthesia was used. In the second group, group B, regional IAN anesthesia was applied. Group A consisted of 7 female and 7 male patients with a mean age of 37.5 years. Group B consisted of 9 female and 5 male patients with a mean age of 40.07 years. Ethical approval was obtained from the Local Ethical Committee of Gülhane Military Medical Academy (reference No. 1491-647-08/1539, May 22, 2008). Approval and informed consent forms were obtained from the patients. At the mylohyoid region and vestibular sulcus, 1 mL articaine HCl (Ultracaine D-S ampoule, 4% articaine HC1 with epinephrine) was applied to all patients in group A. Mylohyoid nerve infiltrations were done under the mylohyoid muscle at the level of the distal root of the first molar teeth (the Figure). For this purpose, the nozzle of the injector was advanced about 1.5 cm into the floor of the mouth and stored supraperiostally under the mylohyoid muscle. In this way, blockage of the MN was provided. In group B, a normal dental implant procedure was accomplished with the help of the BN block and the IAN (1 mL Ultracaine D-S, Articaine HCl/epinephrine HCL) anesthesia using the direct method.

After anesthetic protocol, pain scores were measured during the surgery. For this purpose, a visual analog scale (VAS) scheme ranging from 0 to 100 was used (Figure). To determine the level of pain, each patient was asked for their pain threshold during the stages of incision, drilling, implant placement, and suturing. The IAN anesthesia was applied to the patients in group A who had excessive pain. Similarly, MN anesthesia was supplied to the patients in group B who had excessive pain, and the operations continued according to preoperative protocol. In addition, whenever patients felt pain over their threshold levels during any stage of the operation, an additional dose of anesthesia was infiltrated. One patient who received IAN anesthesia in group A and 2 patients who received MN anesthesia in group B were considered unsuccessful. The VAS values of these patients were accepted as 100.

Results

Pain levels felt during the operations are shown in Table 1. All patients stated that they did not feel any pain during incision (100%). Eight patients (54.2%) stated that they did not feel any pain during drilling. One patient (7.1%) scored pain at a level of 10. Two patients noted pain at a level of 20. Two patients scored a level of 30, and 1 patient reported pain at the level of 40. One patient who had pain greater than 40 received IAN anesthesia that was applied auxiliary to the MN block. The VAS value of this patient was accepted as 100.

During implant placement, 3 patients (21.3%) reported no pain. Five patients (35.5%) scored pain at the level of 10. One patient (7.1%) had pain at the level of 20. Two patients (14.5%) expressed pain at the level of 40. At this stage, IAN anesthesia was not applied. During the suturing, 4 patients (28.4%) did not have any pain. Seven patients (49.7%) reported pain at the level of 10. One patient (7.1%) felt pain at the level of 30, and 1 patient (7.1%) had pain at the level of 60. Additional MN anesthesia was applied to the patient who felt pain at the level of 60. The VAS value of this patient during suturing was accepted as 100.

As a consequence, dental implant placement was achieved successfully by the application of 1 mL mylohyoid and buccal block anesthesia in all but 2 patients. Incisions were painless for patients in group B who received IAN anesthesia (Table 2). Pain occurred in 2 patients (14.2%) at the level of 60 during drilling, and the operation was finished after additional anesthetic infiltration to the MN. These patients were also accepted as being unsuccessful, and their VAS value was accepted as 100. All patients reported no pain during implant placement. During suturing in 2 patients (14.2%), pain occurred at the level of 50, and these patients were supported with additional infiltrations.

Discussion

IAN block failures are unavoidable aspects of dental practice. The common causes of failure in IAN block are touching bone too soon on the anterior ascending ramus or injecting inferior to the mandibular foramen due to the position of the foramina, which is of great importance in IAN block anesthesia, do not have a consistent location between patients.[15] In most cases, the dentist who experiences the odd failure rectifies the problem with a repeat injection.[15] Faulty needle placement and failure to aspirate before injection, which could lead to intravascular deposition of solution, might also lead to failure of anesthesia by redounding the risk of cardiovascular complications. In addition, this commonly used technique eliminates all somatosensory perception of the mandible, mandibular teeth, floor of the mouth, and ipsilateral tongue. Generally, the dentist or surgeon desires these structures to be anesthetized. However, in the placement of mandibular implants, it may be useful for

TABLE 1
Visual analog scale of group A

Name, Surname: Age: …..\....\.....

1.INCISION

VISUAL ANALOG SCALE

0	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**

2.DRILLING

VISUAL ANALOG SCALE

0	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**

3.IMPLANT PLACEMENT

VISUAL ANALOG SCALE

0	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**

4.SUTURING

VISUAL ANALOG SCALE

0	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**

Region:

Number of implant:

Anesthesia: **……. ml**

Nervus Mylohyoideus **Nervus Alveolaris İnferior**

Table 2
Visual analog scale of group B

Procedure	Visual Analog Scale (Group A; n = 14)										
	0	10	20	30	40	50	60	70	80	90	100
Incision	n = 14	—	—	—	—	—	—	—	—	—	—
Drilling	n = 8	n = 1	n = 2	n = 2	—	—	—	—	—	—	n = 1
Implant placement	n = 3	n = 5	n = 1	n = 2	n = 2	—	—	—	—	—	—
Suturing	n = 4	n = 7	—	n = 1	—	—	—	—	—	—	n = 1

the patient to be able to sense when the IAN is in danger of being damaged, possibly producing permanent paresthesia.[16]

As an alternative, MN block could be preferred instead of a regional IAN block. An appropriate MN block impairs the need for the surgeon's experience and is a reliable technique compared with the IAN block. Although the floor of the mouth is a well-vascularized area, the risk of damage to the arteries and veins could be avoided by aspiration before injection. Nevertheless, the IAN block represents a greater risk of infections and neural and ocular complications.[17,18]

There are some studies supporting the necessity of blocking MN during routine IAN anesthesia.[9] In an anatomic study, the branching level of the MN and the IAN was found to be positioned 14.7 mm over the mandibular foramen.[19] There are many hypotheses about prevention of the MN from being blocked during routine IAN anesthesia:

1. The MN can branch above its known level in the infratemporal fossa, and thus the nerve may not be affected from an anesthetic agent.[20,21]
2. Since the sphenomandibular ligament separates IAN and MN from each other, it may not be affected from an anesthetic agent.[22]
3. The MN may not be suppressed by routine IAN anesthesia due to direct transition of the MN to the opposite side directly from the midline.[9]

The MN anesthesia is recommended as an infiltrative on the lingual region of the operated wisdom teeth and if inadequate anesthesia was provided with conventional IAN anesthesia.[14] Sillanpaa et al notified the state of anesthesia over the molar teeth by 21% for patients receiving MN anesthesia. However, they defended that this state of anesthesia was not related to MN anesthesia. The main reason was the fine lingual cortex thickness that allowed distribution of local anesthesia to the first molar teeth directly as an infiltrate. Again, it was clearly demonstrated that MN anesthesia by itself is not able to provide pulpal anesthesia of the mandibular teeth.[23] In another study, failure of regional anesthesia during dental procedures was attributed to the possible presence of MN fibers in the mandibular posterior teeth.[24]

There are more neuroanatomic studies that focus on pulpal innervations of the anterior teeth by the MN through the foraminas on the retromandibular region and the cutaneous branch[8,9,19,20] than studies covering MN innervation of the mandibular molar and premolar teeth, by which the MN entered the mandibula by a branch on the lingual surface of the mandibular posterior teeth.[6,25–27] Haveman and Tebo reported the existence of the foramina with the frequency of 53.5% of the MN over the medial surface of the mandibula during their study of 150 dry craniums.[26] An accessory foramen related to the MN and the mylohyoid groove on the lingual aspect was demonstrated by Sutton.[6] A small foramen was found at the mandibular basis opposing the premolar region on the lingual aspect in 68.92% of the samples.[27]

In fact, the pain exceeded the threshold value during drilling in 3 patients from group B, which mandated application of MN anesthesia. In a few patients, the MN block was found to provide sensitive innervations not only on the teeth of the mandibular posterior region but also on the bone tissue. In both groups, pain score values differed from the levels of the pain threshold of each patient. For example, a patient with a pain level of 50 gave permission to continue the process. But another patient with a pain level of 40 stated that he could not bear the pain. However, the threshold level of none of the patients was coerced, and the anesthesia method was changed based on statements of patients who requested an increase in dose. Thus, that method was considered to have been successful for the patients whose operations could have been completed.

Another outcome of this study related to MN anesthesia could be explained as the following: the distance measured between the IAN and the alveolar crest determines the length of an implant to be placed. Going beyond that distance would be an overkill, which may cause temporary or permanent injury to the IAN. Since the neural tissue is suppressed physiologically with local anesthesia, patients expressed no pain under regional IAN block, even though the IAN nerve was mutilated. The pain felt by patients during implant surgery under MN anesthesia could be attributed to the anatomical proximity of the IAN to the working drill or implant tapping. As far as the sensitivity felt by the patient did not exceed the pain threshold level, it can be considered as an advantage for the operator to prevent any possible IAN injury.

On the other hand, blockage of the IAN was implemented by the storage of local anesthetic substance over the mandibular ramus and mandibular foramen and its locality within the pteryomandibular region. Intravenous or intra-arterial injection of the anesthetic substance causes serious systemic complications. Since the patients were individuals generally at middle age and older, the systemic affect of the local anesthesia can be observed by means of excessive cardiovascular load or symptoms. For this reason, application of MN anesthesia, as a local infiltrative blockage versus the regional blockage of mandibula, is likely less risky during placement of dental implants.

Conclusion

The superiority of the IAN in oral surgery of the mandible is indisputable. However, the MN block represents a safe and simple alternative technique in dental implant surgery. Therefore, the MN block provides the opportunity to estimate whether a dental implant approaches the IAN during implant placement by means of verbal or physical responses of the patient. To prevent any IAN injury during mandibular implant placement, MN anesthesia can be considered an applicable method.

Note

This study was presented in the 16th conference of Turkish Association of Oral and Maxillofacial Surgeons, November 3–8, 2009, Ürgüp, Nevşehir.

Abbreviations

BN: buccal nerve
IAN: inferior alveolar nerve
MN: mylohyloid nerve
VAS: visual analog scale

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