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A Randomized Clinical Trial on the Efficacy of Infiltration Versus Block Anesthesia for Dental Implant Surgery in the Posterior Mandible

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Abstract

Aim is to examine the anesthetic success rate of lidocaine administered by local infiltration or by inferior alveolar nerve block upon dental implant placement in the posterior mandible. The study follows a randomized control clinical trial design. Based on sample size calculation, a total of 167 patients were selected. Their treatment plan included dental implant placement in the posterior mandible. The subjects were randomly placed in two groups. In group A (n=83), a combination of inferior alveolar nerve block and buccal infiltration was performed. In group B (n=84), the anesthetic drug was administered only by local infiltration buccally and lingually. The anesthetic solution was 2% lidocaine with 1:80000 adrenaline. The success rate in group A was 96.1% and in group B was 95.2%. The difference was not statistically significant (X^2=0.915, 1 df, p=0.339). For dental implant placement in the posterior mandible, local infiltration is an equally efficient anesthesia technique as the inferior alveolar nerve block.

Keywords: Local infiltration anesthesia; Inferior alveolar nerve block; Dental implants; Posterior mandible

Introduction

The inferior alveolar nerve block (IANB) anesthesia is regarded as the technique of choice for dental restorative and surgical procedures in the posterior mandible, since it eliminates all perception in the mandibular tissues and teeth, except for posterior buccal gingivae, and it assures a pain-free and comfortable treatment [1]. It is widely accepted that local infiltration should be avoided in the posterior mandible, since the anesthetic effect is usually inadequate for surgical procedures in the jaw bone or the tooth pulp [2-4]. The increased thickness and density of the cortex in the posterior mandible is suggested to limit diffusion of the anesthetic drug into the jaw bone, which is considered as the main reason behind the inadequate anesthetic effect. Nevertheless, more recent studies revealed that beside the technique, the outcome of local anesthesia may be influenced by several factors such as premedication of the patient [5,6], the anesthetic compound [7-11], the injected volume [12] and the presence of additives in the anesthetic solution [13,14]. Occasionally, anatomic variations in jaw structures may also affect the success rate of anesthesia [15-18].

IANB success rate is in the range 70-90% [19-21]. Among the disadvantages of IANB are the prolonged anesthesia of an extended mandibular region that may lead to self-injury and an uncomfortable feeling and possible systemic reactions if the solution is injected intra-arterially [22]. Other common complications may be needle insertion-related ones, e.g., hematoma, pain during injection, paresthesia, trismus, infection, edema, facial nerve paralysis, needle breakage, and unusual neurological symptoms [23], whereas even distant, albeit rare complications, such as ipsilateral ocular disturbances may occur [24-26].

Compared to IANB, mandibular infiltration anesthesia (MIA) has none of the above-mentioned disadvantages and much fewer and less severe complications as well. Moreover, MIA does not totally block the inferior alveolar nerve, which allows the patient to sense if the nerve is close to be damaged by the surgical procedure and to apprise the dentist of it [22]. This advantage of MIA is most important in dental implant placement in the posterior mandible. MIA could help to avoid alteration of sensation that is the most serious complication of this surgical procedure with an incidence of up to 13% [27-29].

In dental implant placement, the use of MIA instead of IANB has been advocated in the past [22]. These authors tested MIA in over 8000 implants during a period of about 30 years. After having considered the pros and cons of the two methods and based on their experience, they suggested MIA as a safer alternative to IANB. However, the study was not a comparative trial between the two methods. Moreover, MIA was applied in the lingual and buccal soft tissues and by subperiosteal injections at the buccal and lingual aspects of the jaw. A total of more than 4 ml of lidocaine solution was used, this volume being larger than the usual one for IANB.

A more recent study [30], also supports the view of applying supraperiostally MIA in implant surgery. However, no comparison group was included and only a small number of participants was included. Considering the above and the limited data existed, the present study was conducted to compare the success rates of MIA and IANB upon dental implant placement in the posterior mandible.

Materials and Methods

Given that the success rate of inferior alveolar nerve block is about 80-85%, we determined that the clinically important difference to detect between the success rates of the two techniques is 15%. With a significance level of alpha set at 5% and the statistical power at 80%,

the minimum number of participants in the study was calculated to be 150. Totally, 167 healthy subjects 25 to 65 years old were included. All subjects were planned to receive implant treatment in the School of Dentistry in Aristotle University of Thessaloniki, Greece. Subjects with signs of inflammation at the surgical site were excluded.

Prior to the surgery, none of the participants received any medication that could alter pain perception. Dental implants were placed in the region of first or second molar of the mandible in all cases by the same surgeon. The anesthetic solution used was 2% lidocaine with 1:80000 adrenaline. The subjects were randomly divided in two groups. In group A (n=83), a combination of IANB (1.8 ml anesthetic solution) and MIA buccally (0.5 ml anesthetic solution) was applied. In group B (n=84), anesthetic was administered only by MIA buccally and lingually (1.8 ml in total).

The anesthesia was considered as failed, if the patient reported pain at the beginning or during the surgical procedure and if so, supplementary anesthetic solution was injected with the technique of IANB. The failure rate was recorded for each group. Comparison between the groups was performed by Chi-square test by using the software SPSS v 17.0 (SPSS Inc., Chicago, Illinois, USA).

Results

There was a total of 258 dental implants placed in 167 patients without any complication during the observation period of 6 months. Failure of anesthesia was recorded in seven and four patients in groups A and B, respectively. Corresponding figures of success rate were 91.6% and 95.2% (Figure 1). The difference in success rate between the groups was not statistically significant (x^2=0.915, 1 df, p=0.339). After completion of the surgical procedure, four patients in group A and two in group B reported that they had sensed a slight pain during the implant placement. However, the patients did not consider it adequately serious to alert the surgeon during the operation. For this reason, these cases were considered as successful.

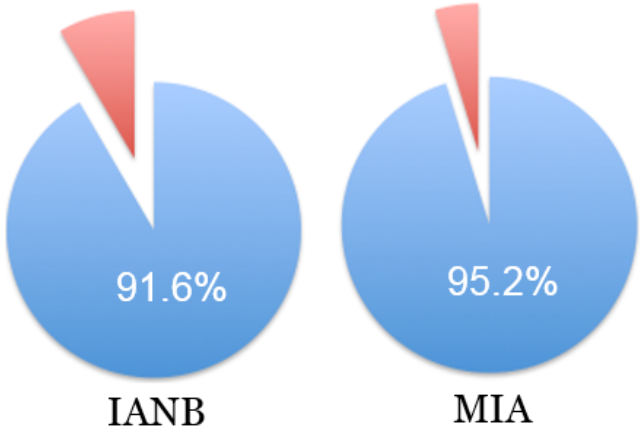

Figure 1: Success rates (blue sectors) of inferior alveolar nerve block (IANB) and mandibular infiltration anesthesia (MIA) for placement of dental implants in the posterior mandible.

Discussion

The present results showed no statistical difference in the anesthetic efficacy of MIA compared with IANB. Irrespective of the technique applied, equally many patients in the two groups experienced painless placement of dental implants in the posterior mandible. The finding that adequate anesthesia is achieved by MIA for this surgical procedure is fully in line with earlier observations [22,30]. Although not being comparative, the previous studies showed a high success rate of MIA, which is presently confirmed and further found to equal the one of IANB.

The advantages of MIA are well acknowledged. From a clinical perspective, MIA is an easier technique than IANB that requires piercing the mucosa at a point between the pterygomandibular raphe and the deep tendon of the temporalis muscle, while the needle is advanced until bone is contacted [21,31]. The most frequent reason of IANB failure is the improper needle placement due to the difficulty in accessing the injection site [32]. The numerous anatomical variations in the route of the inferior alveolar nerve [33-35] may further increase the failure rate.

On the other hand, MIA overcomes the difficulty of the needle placement. It also leads to a restricted extent of the anesthetized area and the anesthetic effect has a limited duration. In implant surgery, MIA allows the patient to sense and warn the surgeon when the safe distance of 2-3 mm over the nerve is encroached [36]. On the contrary, the anesthesia obtained by IANB allows no sensing any injury in the involved nerves and the complication will not become apparent until the anesthetic effect subsides. It should also be kept in mind that IANB can cause transient or permanent nerve damage [37], a complication that might lead to diagnostic confusion in case of placing dental implants in the posterior mandible, since any surgeon would usually assume that the nerve has been injured by the drill or implant itself and may replace or remove such implants with undue reason.

In this study, the success rate for MIA is over 95% and the failure rate is obviously irrelevant to anatomical aspects. Also, the success rate of IANB was 92% that is relatively higher than the average mentioned rate in the literature. This may be attributed to the fact that IANB was performed by the same and very experienced surgeon in all patients.

The anesthetic compound presently used was lidocaine. In most of the recent studies, articaine is prefered to achieve pulpal anesthesia in the posterior mandible [38,39]. These studies demonstrate significantly higher success rates of pulpal anesthesia when using solution of 4% articaine combined with 1:100000 adrenaline. It appears that articaine is more effective compound than lidocaine [7,40]. Thus, it is plausible to assume that articaine may provide an equally high if not higher success rate if used in MIA for implant surgery as well.

One of the limitations of the present study is the fact that no attempt was done to determine the duration of anesthesia. However, the surgical procedure was accomplished within one hour in most cases, which indicate that the effect of MIA may last if it is usually required to perform the specific surgical procedure.

In conclusion, the efficacies of MIA and IANB are high and similar when placing dental implants in the posterior mandibular region. MIA is easier to apply and a safer anesthetic procedure than IABN since it is free from the block-related complications encountered in such cases. Based on the present and previous data outlined above and considering the advantages and disadvantages of the two techniques,

we suggest that MIA should be the anesthetic procedure of choice and not only an alternative to IANB in any case of dental implant surgery.

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