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COMPARATIVE EVALUATION OF PAIN PERCEPTION DURING DENTAL IMPLANT PLACEMENT: INFERIOR ALVEOLAR NERVE BLOCK VS SUPRAPERIOSTEAL INFILTRATION ANAESTHESIA

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Abstract

Objective

To compare the intensity of pain perceived by patients during inferior alveolar nerve block anesthesia versus infiltration anesthesia during the placement of the implant, taking into account factors such as the intensity of pain related to drilling and placing the implant, the implant's proximity to the mandibular canal, and other clinical parameters.

Study Design

Quasi-experimental study

Duration and Place of Study

For a period of six months (April 2024 to September 2024) in Armed Forces Institute of Dentistry, Rawalpindi.

Methodology

This study comprised 44 patients who required bilateral implant insertion in the posterior mandibular area. Two groups were assigned depending on the anesthesia administered during implant placement. Inferior alveolar nerve block (IANB) was administered to patients in Group A, and supraperiosteal infiltration was given in Group B. Each mandibular side had a certain number of placed implants, the distance between the mandibular canal and each implant, the patients' age, gender, and their experience of discomfort were documented and statistically examined. Statistical analysis was done using SPSS software.

Results

44 patients received 125 implants in total, with Group A having 66 implants placed and Group B having 59 implants placed. During implantation, Group B experienced noticeably more discomfort than Group A ($p = 0.001$). However, no statistically significant difference was recorded among the two groups' documented levels of pain during implant drilling ($p = 0.387$). Significant correlation was observed between distance between mandibular canal and implant placement.

Conclusion

Both forms of anesthesia, IANB and infiltration can be used during implant placement and drilling. IANB is more effective in reducing levels of pain experienced by patients undergoing implant placement in the mandibular region.

INTRODUCTION

The control of pain is an essential part of dental practice, in particular in the treatment of hard and soft tissues such as in dental implant surgery.[1] For the posterior mandible, deep local anesthesia is necessary both to manage patient anxiety and to guarantee treatment success.[2,3] Within this area, the IANB has traditionally been the technique of choice because the dense cortical bone in this area does not allow for the successful administering of infiltration anesthesia.[4] Nevertheless, IANB has a number of possible complications such as damage to the nerve, haematoma, trismus and occasionally compromised anaesthesia.[5] Considering the rising popularity in minimally invasive procedures and the improved patient comfort associated with them, there is growing interest in examining other anesthetic techniques that might yield comparable efficacy in a lower-risk manner.[6]

The recent evidence has challenged the requirement of IANB in all cases of posterior mandibular implant surgery, and alternative anaesthetic methods for the same was studied like buccal infiltration by some researchers. Monteiro et al. (2024) reported a 87.5% rate of success for buccal infiltration with 4% articaine in mandibular molars with irreversible pulpitis, indicating its successful diffusion in dense mandibular bone.[7] A randomized control trial conducted by Esteve-Pardo et al. (2022), reported no difference in pain perception when patients receiving IANB were compared to patients receiving infiltration anesthesia for implant placement, even when near the mandibular canal implants were placed.[8] Heller and Shankland (2001) also advocated for infiltration anesthesia as a promising option in posterior mandible regions, especially where the operative site is anterior to the mandibular foramen.[9] In addition, Porporatti et al. (2017) stressed that the somatosensory profiles of pain related to implants are distinct from those of pulpitis or neuropathic pain, supporting the necessity to adapt anesthetic approaches to the nature and location of the procedure.[10]

However, no comprehensive study has yet directly compared pain intensity experienced by patients for these two methods (IANB and IA) of implantation at the time of drilling a hole, especially for clinical factors such as the depth of the drilling, relative position of implant to the mandibular canal, and anatomical proximity to the inferior alveolar nerve. The purpose of the present study was to evaluate the pain intensity of patients who receive IANB and infiltration anesthesia during its use for implant placement, considering the drilling, implant placement, proximity to mandibular canal, and other clinical parameters.

Methodology

The study design was a double-blind, split-mouth, non-randomized comparative study and was conducted at the Armed Forces Institute of Dentistry, Rawalpindi, from April 2024 to September 2024. Armed Forces Institute of Dentistry ethically approved this study (vide ltr no. 918/Trg/05/Apr/2023). Patients reporting to the outpatient department of the Armed Forces Institute of Dentistry, Rawalpindi, and planned for implant surgery were selected. Sample size was determined using OpenEpi sample size calculator for matched-pair designs (split-mouth) at 0.05 significance, power of 90%, and a medium effect size (Cohen's d = 0.5).[8] According to these settings, the lowest required sample size was 44 patients. Informed consent was obtained from the participants, and an option to withdraw at any point during the study was given.

Inclusion criteria: Age range 18-65 years, patients presenting with bilateral posterior mandibular edentulous spaces, no debilitating disease, or bleeding disorders were included in the study.

Exclusion criteria: Medically compromised patients, implant surgery contraindication due to underlying condition, dentists, dental nurses or assistants (who knew IAN and infiltration techniques), patients requiring complicated pre-prosthetic surgeries (guided bone regeneration), and patients with neurological disorders were excluded from the study.

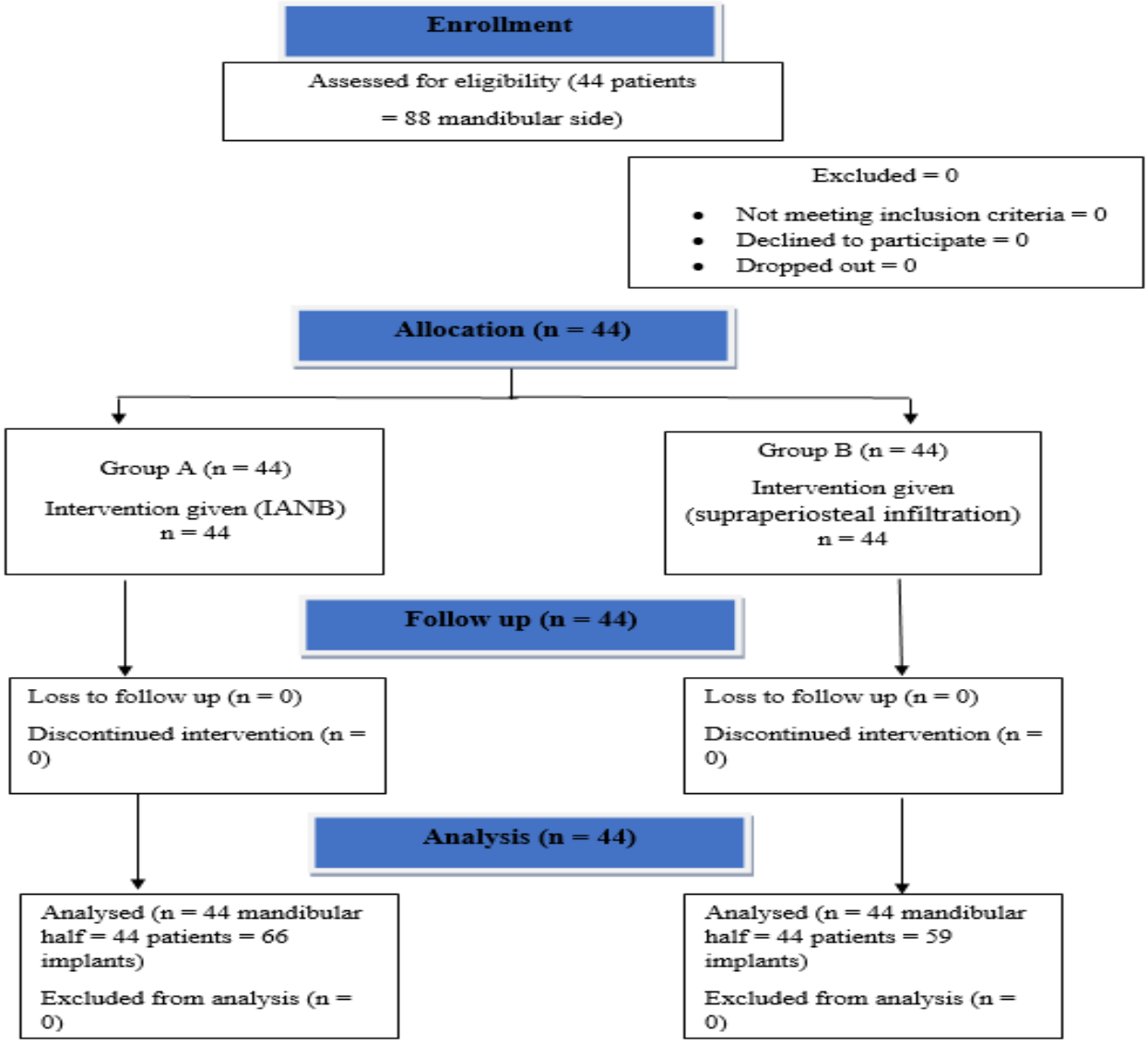

Figure 1. Patient flow diagram

Every participant went through a process of proper clinical examination, through examination of systemic and local factors, and standard investigations (OPG, CBCT) for planning of surgical procedure and implant placement. To prevent the possible side effects of anesthesia on the evaluation of patient's pain response, implant placement with either of the anesthetic techniques (block or infiltration) was done on one side, followed by a 3-week gap before placement on the other side.

The administration of anesthesia was done by one of the clinicians taking part in the study, without the knowledge of the treating surgeon and the patients, to ensure a double-blind study. The patients were given folded envelopes to pick, for the particular anesthetic technique to be used in their case, and were not told about it. A 1.8 mL solution of 4% articaine with 1;100,000 epinephrine was used in all the cases.

The participants were distributed among two groups. In group 1: IANB was administered according to Halstead approach. After

confirmation of anesthetic effectiveness, a supplemental infiltration was then given for the buccal nerve. In group 2: A supra-periosteal technique was used to administer mandibular infiltration anesthesia with an additional 0.3ml solution under the lingual periosteum to ease the flap manipulation. If two attempts at achieving effective anesthesia failed, that particular participant was excluded from the study.

If the effectiveness of anesthesia was established, the first operator left the surgery and the second operator took over the procedure. The surgical steps included marking the area of surgical procedure, raising a mucoperiosteal flap, using an implant motor at 800-1000 rpm with copious irrigation, implant placement, healing abutment, and suturing. The subjects were guided to instruct the operator if they felt any pain and identify it accordingly on the Visual Analog Scale (VAS), which has markings from 0 to 10, where 0 indicates no pain and 10 indicates worst pain imaginable. After the procedure, the exact position of the implant in the alveolus was checked with either an OPG or CBCT, and the distance between the mandibular canal and implant apex was recorded for each patient.

Statistical analysis was done using Statistical Package for the Social Sciences (SPSS) version 24. Normality of the data was assessed by Shapiro-Wilk test. Mann Whitney test and Kruskal Wallis test was used to compare distribution of pain across both groups. Correlation analysis was done using Spearman correlation. Significance of the results was assessed at 5% level.

Results

A total of 125 implants were placed in 44 patients, with Group A having 66 implants and Group B having 59 implants. In group A, implant placement between no adjacent teeth was 37, adjacent to one tooth was 17, and between two adjacent teeth was 12. Similarly, in group B, implant placement between no adjacent teeth was 31, adjacent to one tooth was 19, and between two adjacent teeth was 9. The mean age of the patients was 43.07 ± 7.9 years, and the gender distribution of 23 males (52.27%) and 21 females (47.73%). No correlation between VAS Score and age (p = .335) and gender (p = .640) was observed.

The pain recorded in Group B was substantially greater than compared to Group A during implant placement (p = 0.001). In contrast, pain recorded at the time of drilling for implant between the two groups was not statistically significant (p = 0.387) (Table I).

Table I. Comparative analysis of pain observed at the time of implant placement and drilling in both groups A and B.

Record of pain during	Group A (n = 66)	Group B (n = 59)	p - value
Implant Placement			
Range	0-4	0-6	0.001*
Mean ± SD	1.35 ± 1.2	2.44 ± 1.7	
Median (IQR)	1 (2)	2 (3)	
Drilling			
Range			0.387
Mean ± SD	0.95 ± 1.0	1.07 ± 0.9	
Median (IQR)	1 (2)	1 (2)	

* Indicates significant values (p < .05)

A significant association between the pain intensity and the existence of adjoining teeth during implant placement and drilling was observed in both groups (p < 0.005). The highest pain recorded was during the placement of the implant adjoining the 2 teeth in group B (mean = 4.78 ± 0.8), while the lowest pain was observed in group A at the time of implant drilling in the edentulous area (mean = 0.35 ± 0.5) (Table II).

Table II. Association between the existence of teeth and the pain recorded at the time of implant drilling and placement in both groups.

Groups	Record of pain during	Presence of teeth			p - value
		Two adjacent teeth	One adjacent tooth	No adjacent teeth	
Group A	**Implant Placement**	(n = 12)	(n = 17)	(n = 37)	<0.001*
	Range	1-4	0-3	0-2	
	Mean ± SD	2.75 ± 0.9	1.88 ± 0.9	0.65 ± 0.8	
	Median (IQR)	3 (1.25)	2 (2)	0 (1)	
	Drilling	(n = 12)	(n = 17)	(n = 37)	<0.001*
	Range	1-3	0-3	0-1	
	Mean ± SD	2.11 ± 0.8	1.21 ± 1.0	0.35 ± 0.5	
	Median (IQR)	2 (1)	1 (2)	0 (1)	
Group B	**Implant Placement**	(n = 9)	(n = 19)	(n = 31)	<0.001*
	Range	4-6	2-5	0-2	
	Mean ± SD	4.78 ± 0.8	3.47 ± 1.2	1.13 ± 0.8	
	Median (IQR)	5 (1)	4 (2.5)	1 (1.5)	
	Drilling	(n = 9)	(n = 19)	(n = 31)	0.001
	Range	1-3	0-3	0-2	
	Mean ± SD	2.33 ± 0.6	1.29 ± 1.0	0.68 ± 0.7	
	Median (IQR)	2 (1)	1 (2)	1 (1)	

* Indicates significant values (p < .05)

In both groups, there was a weak to moderate negative correlation between the maximum pain observed while drilling and the distance from the mandibular canal, with values of r = -0.402 (p = observed in group A (r = -0.309, p = .001), while a stronger negative correlation was found in group B (r = -0.545, p < .001) (Figure 2). A significant duration of surgery (p < .001).

.001) in group A and r = -0.277 (p = .024) in group B. At the time of implant placement, a moderate negative correlation was

association was also observed between pain observed during implant placement and drilling and

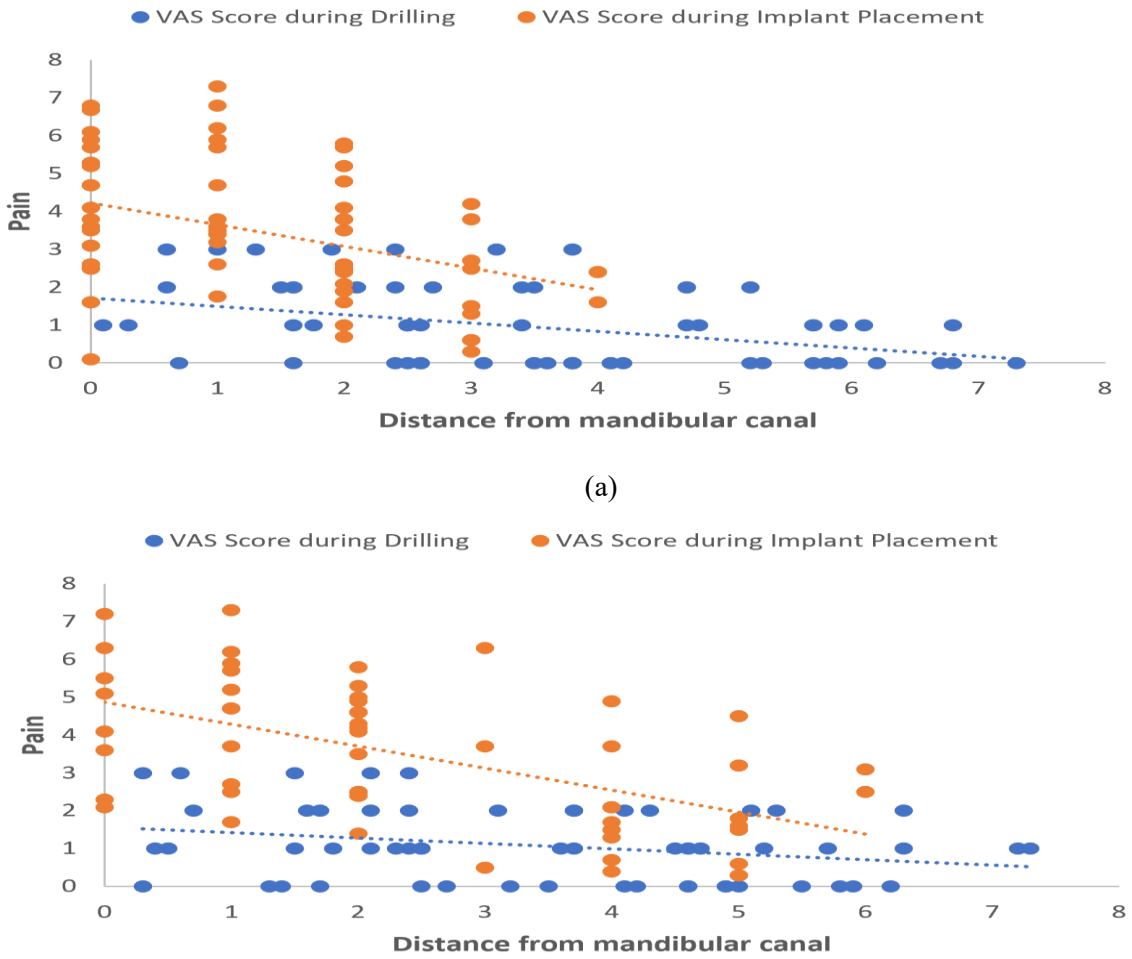

Figure 2. Correlation analysis between the distance from the mandibular canal and pain experienced during drilling and implant placement in both a) Group A and b) Group B

Discussion

This study did a comparison between the pain experienced by patients during implant placement and drilling under local anesthesia via two anesthetic techniques, i.e., inferior alveolar nerve block (IANB [Group A]) and infiltration anesthesia (Group B). The findings of significantly lower pain scores of Group A during implant insertion (mean VAS: 1.35 ± 1.2 vs. 2.44 ± 1.7 in Group B, P =. 001), with no drilling effect (p =. 387). Also, pain severity was associated with the presence of adjacent teeth, the greatest pain occurring in Group B, when there were two teeth next to implants (mean VAS value: 4.78 ± 0.8).

Murat et al. reported that IANB offered more effective pain control in pediatric molar extraction because of complete nerve block of the mandibular nerve.[11] Similarly, H A et al. (2023) found that IANB resulted in mean pain scores of 2.1 ± 1.0 for premolar extractions, compared to 3.4 ± 1.2 with infiltration,[12] further consolidates our findings that IANB was more effective compared to infiltration. Yet our drilling-phase outcomes (Group A: 0.95 ± 1.0 vs Group B: 1.07 ± 0.9, p =. 387) differ from Komsic et al. (2025) who observed greater infiltration-related pain (2.3 ± 0.8) compared to IANB (1.5 ± 0.6, p = 0.02) for mandibular premolar treatment.[13] This discrepancy could be explained by variations in

surgical invasiveness between the dental molar extraction and our own drilling procedure, which was less traumatic to the tissue. The significant pain reported in Group B for implant insertion between two teeth (4.78 ± 0.8) compares favourably with that reported by Elchaghaby et al. s (2023) study, and infiltration anesthesia produced a mean VAS score of 4.2 ± 1.1 in mandibular molar areas compared to IANB (2.0 ± 0.7; $p < 0.001$).[14] Their conclusion that infiltration "loses effectiveness when it comes close to nervous structures" is thereby reinforced by our finding of the negative relationship observed between pain and mandibular canal distance (Group B; $r = -0.545$, $p < 0.001$). The limited depth and duration of anesthesia during implant implantation may have contributed to the higher VAS values for infiltration anesthesia as proposed by Bartlett & Mansoor.[15] However, the somewhat greater pain during drilling process in group B as opposed to group A are also consistent with Gülnahar et al., demonstrating that infiltration anesthesia's efficacy may decrease in regions with dense cortical bone or under extended surgical stress.[16]

Consistent with previous research, there is a noteworthy correlation between the proximity of the implant site to the mandibular canal and the pain intensity felt by the patients during implant placement and drilling.[17,18] The success rate of infiltration anesthesia is comparatively lower than nerve block approaches in pain management in structures that are deep and closer to the mandibular canal. This is particularly more important in surgical operations like implant placement.[19] In addition to improving pain management, IANB's effectiveness in preserving anesthesia during the treatment accelerates and streamlines the surgical workflow. As a result, it reduces patient discomfort brought on by lengthy surgical procedures.[20] In addition to improving pain management, IANB's effectiveness in preserving anesthesia during the treatment accelerates and streamlines the surgical workflow. As a result, it reduces patient discomfort brought on by lengthy surgical procedures.[21]

The study had a few limitations such as the analysis was based on patient-reported VAS scores, which are subjective and may be affected by the patient's pain tolerance and level of anxiety, although they are frequently applied. Moreover, although the split-mouth design minimized the interpatient variability, the potential bias might occur as the patients might have compared the pain perception for the two methods. Third, potential confounding factors were not considered in the study, including differences in surgical difficulty, bone density, or operator skill that could influence pain perception.

Conclusion

Dental implant drilling and implantation can be accomplished using both IANB and infiltration anesthesia. However, because the patient may feel some discomfort during implant insertion, articaine infiltration anesthetic may give the surgeon an early indication of proximity to the inferior alveolar nerve. Potential nerve damage could be prevented with the help of this warning.

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