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ORIGINAL ARTICLE

Is it possible to extract lower third molars with infiltration anaesthesia techniques using articaine? A double-blind randomized clinical trial

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ABSTRACT

Objective: To compare the efficacy and safety of inferior alveolar nerve blocks (IANB) with additional buccal infiltration (standard technique) and of buccal and lingual anaesthetic infiltration (experimental technique) for lower third molar (L3M) extractions.

Study design: A randomised, double-blind clinical trial involving 129 L3M extractions was conducted. In the IANB group, an IANB was performed using the conventional approach, followed by a buccal injection in the extraction area. In the infiltration group (INF), an infiltration was performed in the buccal and lingual areas of the lower second molar. A 4% articaine solution was employed in all cases. The main outcome variable was anaesthetic efficacy. Other variables like intraoperative and postoperative pain, onset time and adverse events were also recorded. Descriptive and bivariate analyses of the data were made.

Results: 120 patients were randomised. The IANB group showed significantly higher anaesthetic efficacy than the INF group (64.4 vs. 45.8%) (odds ratio = 0.47; 95% confidence interval = 0.22–0.97; $p = 0.042$). No complications were observed.

Conclusions: IANB with additional buccal infiltration is more suitable than the experimental technique for achieving adequate analgesia in L3M extractions. Moreover, the standard method is safe and provides a shorter onset time and lower initial postoperative pain levels.

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KEYWORDS
Dental anaesthesia; inferior alveolar nerve block; third molar; postoperative pain

Introduction

Lower third molar (L3M) extraction is a common procedure that is usually performed in an outpatient setting under local anaesthesia. Traditionally, inferior alveolar nerve blocks (IANB) have proved efficacious in achieving adequate anaesthesia for mandibular molar extraction. Nevertheless, their success rate is not optimal and several complications such as intravascular injection, neurologic lesions [1–3] or ipsilateral necrosis of the chin skin [4] have been described. For these reasons, several authors have proposed mandibular infiltration techniques, also known as field blocks, as an alternative to IANB [5–7].

Articaine is a local anaesthetic that contains a thiophene group. It is considered safe and effective, and has an adequate duration for L3M extractions [8–10]. Recently, some studies have assessed the efficacy of articaine in achieving pulpal anaesthesia with infiltration techniques in the buccal and/or lingual areas of the mandibular teeth, with promising results [5–7,11,12]. El-Kholey [13] suggested that infiltrating 3.6 cc of articaine 4% with epinephrine 1:100,000 in the buccal area and 0.4 cc in the lingual zone would be sufficient to extract a L3M in most cases. Although some published studies have compared the anaesthetic effects of infiltration techniques and IANB, to the best of our knowledge no randomised clinical trials have been conducted in L3M extractions.

Thus, the main objective of this study was to compare the anaesthetic efficacy of inferior alveolar nerve blocks (IANB) and additional buccal infiltration (standard technique) with that of buccal and lingual anaesthetic infiltration (field block) for lower third molar (L3M) removal. In addition, the complications associated with the two techniques were analysed.

Materials and methods

A double-blind randomised clinical trial was conducted in accordance with the Declaration of Helsinki on human studies, following approval from the Research Ethics Committee (CEIC) of the Dental Hospital of the University of Barcelona (protocol number 2016-19). The subjects were recruited for the study in 2017 and 2018. The study was also registered with and approved by ClinicalTrials.gov (NCT03443726; https://clinicaltrials.gov/ct2/show/ NCT03443726) and is

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reported in accordance with the CONSORT statement [14]. All the volunteers provided written informed consent during a pre-treatment screening period before any study procedures were performed.

The study population comprised healthy volunteers (American Society of Anaesthesiologists physical status I or II) [15] between 18 and 60 years of age who required extraction of a L3M without caries or signs of acute pericoronitis. The exclusion criteria included any infection in the orofacial region in the last 30 days; pregnancy or current lactation; allergy to local anaesthetics or any other medication; any condition contraindicating the use of local anaesthetics with vasoconstrictors; a recent history of trauma at the extraction site; absence of the adjacent lower molars; presence of caries, metal or ceramic crowns on the L3M or adjacent molars; and heterotopic L3Ms. They also included patients with a pre-operative Corah's Dental Anxiety Scale score of >13 [16]. Volunteers were withdrawn from the study if any of the following occurred: lack of protocol adherence and/or surgical procedures lasting more than 60 min (Figure 1).

Intervention

Each patient attended 3 appointments (initial appointment, surgical procedure and postoperative follow-up visit 7 days later). During the first session, the patient's medical history was recorded and a panoramic radiography was performed to determine the position of the L3M according to the classification systems outlined by Pell and Gregory [17] and by Winter [18], as well as the relation between its roots and the mandibular canal (inferior alveolar nerve – IAN – non-superimposed or superimposed).

Electric pulp tests (Vitality Scanner Model 2006®; SybronEndo; Orange, CA) of the L3M – or the adjacent tooth if the L3M was impacted – and the contralateral tooth were performed three times before the injections were given, to record baseline vitality. Electrocardiogram gel was applied to the probe tip, which was placed in the middle third of the buccal surface of the tooth being tested. The researcher increased the output from zero (0 μA) to maximum (80 μA) in 25 s. All the tests were conducted by trained personnel (S.S. and E.S-P.) and the reading was recorded when the patient reported any sensation.

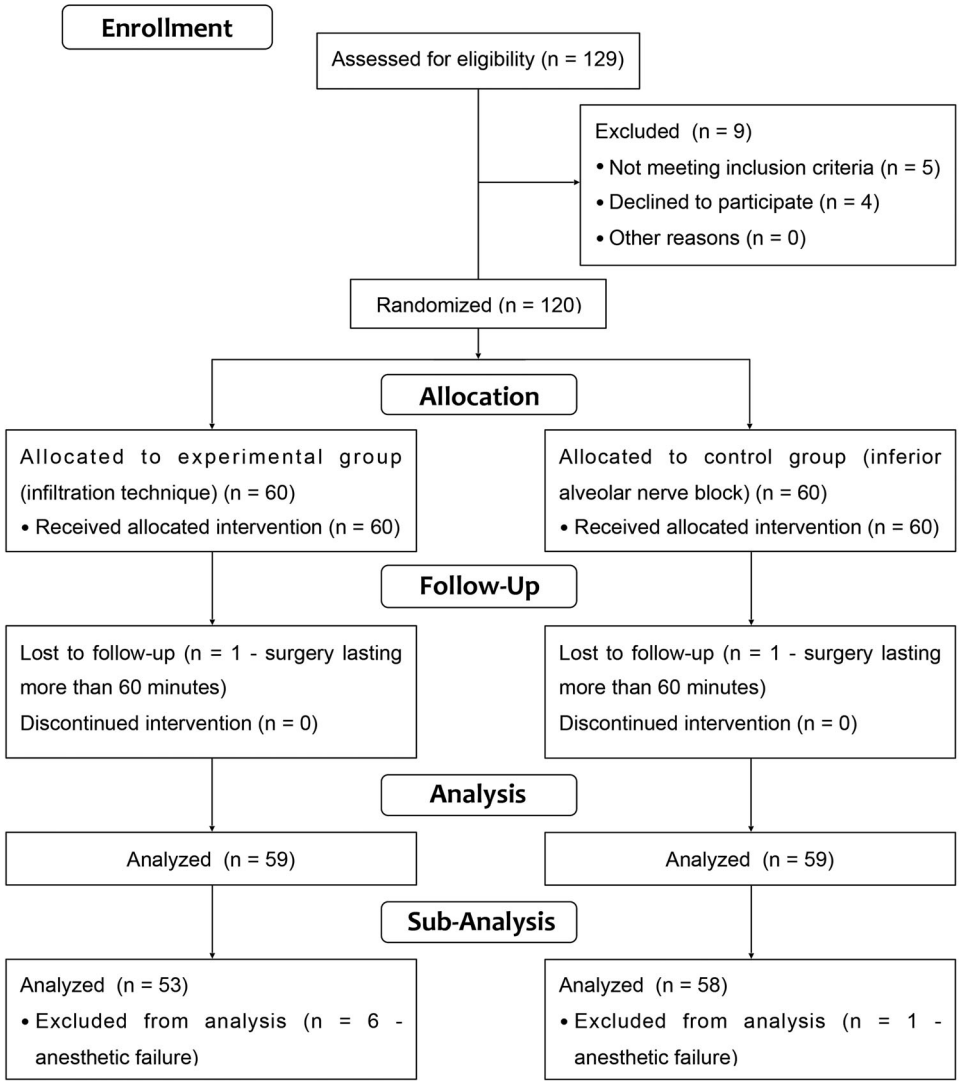

Figure 1. Flow diagram showing the patients included in each stage of the trial.

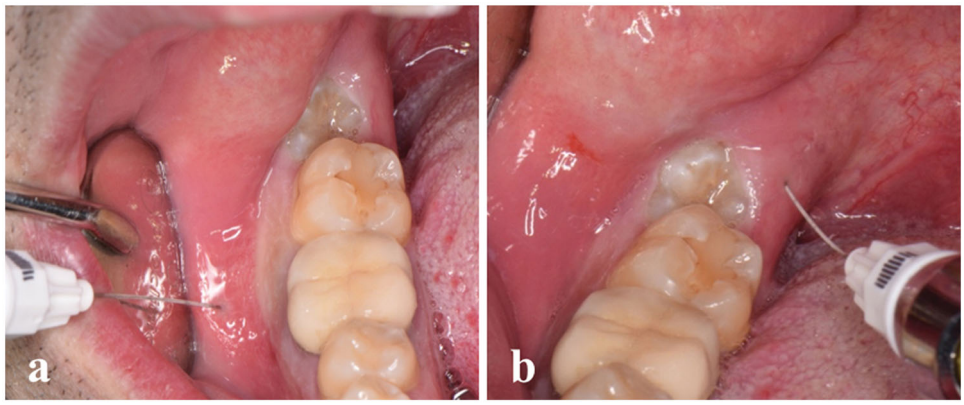

Figure 2. INF intervention. (a) Conventional infiltration technique in the buccal area between the lower first and second molars. (b) Infiltration technique in the lingual mucosa of the L3M.

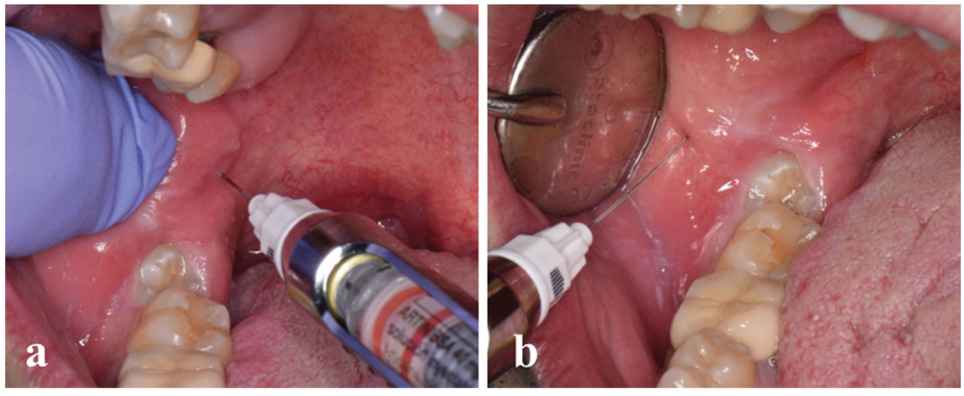

Figure 3. IANB intervention. (a) IANB technique using the conventional Halsted approach. (b) Additional infiltration of anaesthetic solution in the buccal region of the L3M.

Two calibrated surgeons (S.S. and E.S-P.), with ~3 years of clinical experience, performed all the local anaesthetic techniques using 4% articaine with 1:100,000 epinephrine (Artinibsa; Inibsa, Lliçà de Vall, Spain). The participants were randomly allocated to either the infiltration group (INF) or the IANB group (IANB), which received, respectively:

1. INF: Infiltration technique (field block) in the buccal area (3.6 cc) between the lower first and second molars and a superficial injection (the needle penetrated 2 to 3 mm) in the lingual mucosa adjacent to the L3M (0.4 cc). This technique is similar to that described by El-Kholey [13], although the buccal injection area is slightly more distal (Figure 2).
2. IANB: The conventional Halsted approach (1.8 cc) as described in a previous report [19], withdrawing the needle 1 mm after bone contact and ensuring negative blood aspiration, followed immediately by an additional infiltration of 0.6 cc of the anaesthetic solution in the buccal region of the L3M (Figure 3).

A separate researcher (R.F.) applied the random allocation according to a computer-generated randomisation list, using sealed, numbered envelopes. Allocation concealment was guaranteed since the patients were assessed for the inclusion/exclusion criteria before randomisation.

UnijectTM® (Hoechst AG, Frankfurt, Germany) syringes were employed for all patients, with a 35 mm long 27 G Monoprotect XL® needle (Inibsa, Lliçà de Vall, Spain) for the IANB and a 25 mm long 30 G MonoprotectXL® needle (Inibsa; Lliçà de Vall, Spain) for the infiltrations. The injection time for each cartridge was ~1 min.

The patients were asked to report any sensation of lip numbness (Vincent's sign). Sixty seconds after Vincent's sign diagnosis the electric pulp test was performed again, then repeated at 30 s intervals, to ensure that the anaesthetic technique had been successful. The criterion used to determine whether pulp anaesthesia had been successful was 2 consecutive negative responses to the maximum pulp stimulus (80 μA). If Vincent's sign was not recorded within 6 min, or sensation continued to be felt before the electric pulp tester reached 80 μA, the case was considered a failure and excluded from further analysis.

All surgeries were performed by fellows of the master's degree programme in Oral Surgery and Implantology (University of Barcelona), who were unaware of which anaesthetic technique had been used. The surgical field and all

the surgical materials were sterile. The surgical technique was similar to that described by Alvira-Gonzalez et al. [20].

The patients were instructed to report any painful discomfort during L3M removal. If pain occurred, intraligamentary and/or intrapulpal anaesthesia were administered, the extraction was completed and the anaesthetic efficacy was classified as unsuccessful. The success rates of these supplemental techniques were not assessed since they lay outside the scope of this study.

All the patients received a leaflet with the postoperative instructions. They were prescribed amoxicillin 750 mg p.o. every 8 h for 4 days (Amoxicilina Normon EFG 750 mg, Normon, Madrid, Spain), ibuprofen 600 mg p.o. every 8 h for 4 days (Algiasdin®; Esteve, Barcelona, Spain) and a 15 ml mouthrinse of 0.12% chlorhexidine digluconate every 12 h for 15 days (Clorhexidina Lacer®; Lacer, Barcelona, Spain). If needed, rescue analgesics (paracetamol 1 g p.o. every 8 h (Gelocatil; Gelos®, Barcelona, Spain)) were available for all the participants throughout the study.

Data sampling

The following data were gathered:

1. Anaesthetic efficacy (primary outcome variable): Number of patients that:
   (a) reported Vincent's sign within 6 minutes after the injection,
   (b) had 2 consecutive negative readings of the electric pulp tester as described above within 6 min after the injection, and
   (c) did not require supplementary anaesthesia during the surgical procedure.
2. Subjective pain during injection: evaluation on a 100-mm visual analogue scale (VAS), with 0 meaning 'no pain' and 100 meaning 'worst pain imaginable'.
3. Electric discharge sensation in the tongue or lower lip during injection.
4. Onset of anaesthetic agent (in seconds) determined by: (a) a tingling sensation in the lower lip, chin and tongue regions and (b) loss of pulpal sensibility.

The following data were also retrieved by a blinded surgeon who did not participate in the administration of the local anaesthetic and was unaware of the allocation sequence:

1. Need for additional anaesthetic infiltrations (volume in cc and anaesthetic technique used for reanesthesia).
2. Duration of surgery after anaesthetic administration (in minutes): time from incision to placement of the last suture.
3. Subjective pain during the surgical procedure, then at 2, 6, 12, 24h, and daily until the 7th postoperative day: evaluation on a 100-mm VAS as at 2 above.
4. Local complications (local irritation, discomfort) or systemic side effects (palpitations, nausea, vomiting, dizziness, etc.) observed by the surgeon or reported by the participant during local anaesthetic administration, during surgery or postoperatively.

Statistical analysis

The sample size calculation was based on the assumption that anaesthetic efficacy is achieved in 92% of the controls [21]. It was estimated that a 15% difference between the groups would be clinically significant. Considering an allocation ratio of 1:1, an α risk of 0.05, a power of 80%, and a 10% exclusion rate, 60 patients per group were required (comparison of two proportions).

The categorical outcomes were presented as absolute and relative frequencies. The normality of the scale variables was explored through Shapiro–Wilk's test and visual analysis of the P–P and box plots. Where normality was rejected, the interquartile range (IQR) and median were calculated. Where the distribution was compatible with normality, the mean and the standard deviation (SD) were used.

The association of categorical variables was assessed with either Pearson's χ^2 test or Fisher's exact test, whereas unpaired Student's t tests or Mann–Whitney U tests were used for scale variables. The odds ratio (OR) with a 95% confidence interval (95% CI) was calculated for each categorical variable. To analyse the effects of the intervention on pain, on time and on the interaction between these two variables, a repeated measures mixed model was used. Fulfilment of the assumptions was checked by exploring the graphical distribution of the residuals. For each follow-up time, pairwise comparisons between groups were performed.

The statistical analysis was carried out with Stata14 (StataCorp®, College Station, TX) by a blinded investigator (O.C.-F.). The level of significance was set at $p < 0.05$, using Tukey's correction for multiplicity of contrasts.

Results

One hundred and twenty-nine patients were assessed for eligibility. Of these, 9 were excluded. The study initially comprised 120 patients with impacted L3M who were randomised to receive buccal and lingual infiltrations or IANB plus buccal infiltration. However, the surgical procedure lasted more than 60 min in 2 participants (one in each group), whose data were discarded in accordance with the preset exclusion criteria. In addition, 6 patients (10.2%) in the INF group and 1 patient (1.7%) in the IANB group experienced early anaesthetic failures (positive electric pulp tests or Vincent's sign not recorded within 6 min) and were excluded from further analysis (OR = 6.57; 95% CI: 0.77 to 56.34; $p = 0.114$). Hence, some variables were not gathered for the latter patients (Figure 1). The demographic data of the 2 study groups are compared in Table 1. The variables related to the efficacy and safety of the interventions are shown in Table 2.

The patients in the INF group showed a significantly longer onset time to achieve lower lip and pulpal anaesthesia (respectively, MD 25.00 s, 95% CI: 0.48 to 49.52, $p = 0.046$; and MD 62.71 s, 95% CI: 32.82 to 92.60, $p < 0.001$) (Table 2).

Table 1. Baseline and clinical characteristics of the patients in the two groups.

	4% articaine with 1:100 000 epinephrine		
	INF	IANB	*p*-Value
Gender [male/female] (%)	26/33 (44.1)	26/33 (44.1)	1.000
Age [years] (SD)	26.84 (8.00)	26.73 (8.55)	0.943
Corah's Dental Anxiety Scale score (SD)	8.10 (2.38)	8.08 (2.34)	0.969
Side operated (right/left)	26/33 (44.1)	33/26 (55.9)	0.197
Pell & Gregory position (%)			0.303
A	14 (23.7)	21 (35.6)	
B	39 (66.1)	31 (52.5)	
C	6 (10.2)	7 (11.9)	
Pell & Gregory position (%)			0.205
I	7 (11.9)	14 (23.7)	
II	47 (79.7)	39 (66.1)	
III	5 (8.5)	6 (10.2)	
Winter position (%)			0.235
Mesioangular	22 (37.3)	26 (44.1)	
Horizontal	17 (28.8)	9 (15.2)	
Vertical	14 (23.7)	20 (33.9)	
Distoangular	6 (10.2)	4 (6.8)	
IAN superimposition [yes/no] (%)	33/26 (55.9)	27/32 (45.8)	0.269
Bone removal [yes/no] (%)†	42/11 (79.3)	44/14 (75.9)	0.670
Tooth sectioning [yes/no] (%)†	33/20 (62.3)	36/22 (62.1)	0.983
Duration of surgery [min] (SD)†	29.44 (14.06)	31.52 (14.05)	0.435

INF: Infiltration group (Buccal and lingual infiltration); IANB: Inferior alveolar nerve block (IANB + buccal infiltration); IAN: inferior alveolar nerve.
†Variables not collected in failure cases.

Table 2. Complications and efficacy-related variables of the patients in the two groups.

	4% articaine with 1:100 000 epinephrine			
Categorical variables	Odds INF (%)	Odds IANB (%)	OR (95% CI)	*p*-Value
Electric discharge tongue (yes/no)	4/55 (6.8)	7/52 (11.9)	0.54 (0.16 to 1.84)	0.342
Electric discharge lower lip (yes/no)	0/59 (0.0)	3/56 (5.1)	0.00 (0.00 to 1.26)	0.244‡
Early anaesthetic failure (yes/no)	6/53 (10.2)	1/58 (1.7)	6.57 (0.77 to 56.34)	0.114‡
Reanesthesia (yes/no)†	26/27 (49.1)	20/38 (34.5)	1.83 (0.86 to 3.91)	0.120
Anaesthetic efficacy (yes/no)	27/32 (45.8)	38/21 (64.4)	0.47 (0.22 to 0.97)	0.042*
Adverse events (yes/no)†	0/53 (0.0)	0/58 (0.0)	****	
Scale variables	Mean INF (SD)	Mean IANB (SD)	MD (95% CI)	
Pain during injection (mm)	28.86 (17.29)	31.98 (20.13)	−3.12 (−9.96 to 3.73)	0.389
Onset time tongue (s)	70.14 (72.36)	92.25 (76.38)	−22.12 (−49.25 to 5.01)	0.109
Onset time lower lip (s)	117.29 (75.05)	92.29 (58.42)	25.00 (0.48 to 49.52)	0.046*
Onset time pulpal (s)	178.98 (96.16)	116.27 (64.43)	62.71 (32.82 to 92.60)	<0.001*
Volume of reanesthesia (cc)†	0.73 (1.05)	0.44 (0.81)	0.29 (−0.06 to 0.64)	0.106

INF: Infiltration group (buccal and lingual infiltration); IANB: Inferior alveolar nerve block group (IANB + buccal infiltration); 95% CI: 95% Confidence interval; SD: Standard deviation; MD: Mean difference.
*$p < 0.05$.
†Variables not collected in failure cases. ‡Fischer exact test.
****Cannot be calculated (absence of events).

Twenty-six (49.1%) patients in the INF group and 20 (34.5%) patients in the IANB groups needed supplementary infiltrations (OR = 1.83; 95% CI: 0.86 to 3.91; $p = 0.120$) (Table 2). Twenty-one of the participants allocated to the INF group required an intraligamentary infiltration; intrapulpal injection was needed in 4 cases and in 1 case both techniques were used. Similarly, 15 and 5 of the IANB group patients required intraligamentary and intrapulpal anaesthesia, respectively. In these cases, similar volumes of the anaesthetic solution were injected in both groups (MD: 0.29 cc; 95% CI: −0.06 to 0.64; $p = 0.106$) (Table 2).

Bivariate analysis showed a significant association between study group and anaesthetic efficacy, with lower values for INF (45.8%) than for IANB (64.4%) (OR = 0.47; 95% CI: 0.22 to 0.97; $p = 0.042$) (Table 2).

No adverse reactions associated with the use of either anaesthetic technique were observed by the researchers or reported by the patients during or after surgery (Table 2).

The postoperative VAS of pain varied significantly over time ($\chi^2 = 202.0$; df = 10, $p < 0.001$). Interestingly, the INF group had higher pain scores 2 h after surgery (MD: 9.71 mm; 95% CI: 1.44 to 17.99; $p = 0.021$) (Table 3 and Figure 4). The pain followed the same pattern of evolution over time in both groups ($\chi^2 = 13.27$; df = 10, $p = 0.209$).

Discussion

IANB with additional buccal infiltration proved more efficacious than the experimental technique (infiltration in the buccal and lingual areas) in achieving adequate analgesia for impacted L3M extraction. Moreover, the standard method was safe and provided a shorter onset time (pulpal

Table 3. Visual analogue scale (VAS) pain scores at 11 time points after lower third molar extraction.

	4% articaine with 1:100 000 epinephrine			
	Mean INF (SD)	Mean IANB (SD)	MD (95% CI)	*p*-Value
Day 0 – During surgery	23.23 (25.88)	20.26 (19.65)	2.97 (−0.53 to 11.24)	0.482
Day 0 – 2 h	37.49 (25.35)	27.78 (27.35)	9.71 (1.44 to 17.99)	0.021*
Day 0 – 6 h	35.43 (22.32)	34.57 (26.09)	0.86 (−7.41 to 9.14)	0.838
Day 0 – 12 h	32.02 (20.81)	34.60 (25.19)	−2.58 (−10.86 to 5.69)	0.540
Day 1	27.06 (20.74)	28.62 (25.95)	−1.56 (−9.84 to 6.71)	0.711
Day 2	25.92 (21.65)	28.84 (22.87)	−2.92 (−11.19 to 5.35)	0.489
Day 3	24.08 (21.16)	25.02 (20.62)	−0.94 (−9.21 to 7.33)	0.823
Day 4	21.26 (19.09)	24.12 (21.91)	−2.86 (−11.13 to 5.42)	0.499
Day 5	19.34 (21.39)	21.41 (21.54)	−2.07 (−10.35 to 6.20)	0.623
Day 6	15.85 (18.72)	16.95 (19.78)	−1.10 (−9.37 to 7.17)	0.795
Day 7	11.98 (16.89)	12.28 (19.16)	−0.29 (−8.57 to 7.98)	0.944

INF: Infiltration group (buccal and lingual infiltration); IANB: Inferior alveolar nerve block group (IANB + buccal infiltration); 95% CI: 95% Confidence interval; SD: Standard deviation; MD: Mean difference.
*$p < 0.05$.

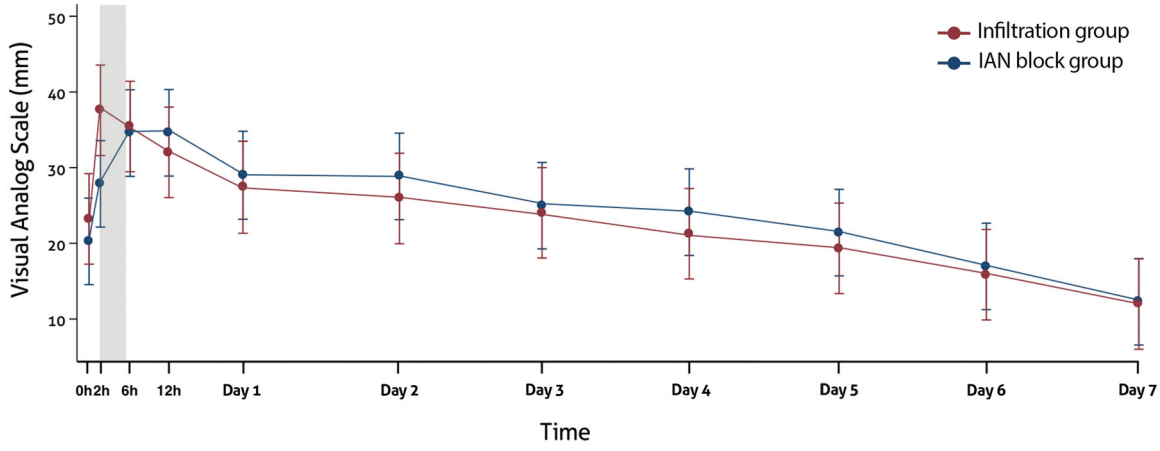

Figure 4. Postoperative pain over time.

anaesthesia was reached ~1 min earlier) and lower initial postoperative pain levels.

A considerable number of patients in both groups required reanesthesia and the overall success rate was lower than expected.

This result could probably be related to the limited time that elapsed between the injection of the local anaesthetic and the beginning of the surgical procedure (Vincent's sign and the pulp tester results might be unreliable for fully or partially impacted L3M extractions). Also, the volume of articaine might be considered insufficient [6]. Thus, clinicians should consider increasing the amount of local anaesthetic and waiting for a longer time before initiating extraction in order to improve the anaesthetic success rate.

Another possible explanation for this outcome might be related to the limited experienced of the surgeons, since all of them were fellows on an Oral Surgery and Implantology master's degree programme. This could constitute a limitation when generalising the outcomes of the present study, since more experienced operators might obtain better results, especially when performing IANB, which is a more complex technique.

Junt et al. [22] obtained different results, since buccal infiltrations proved as effective as IANB in achieving pulpal anaesthesia in the mandible. However, they used healthy volunteers, did not perform any real treatment, and applied these techniques at the first molar, where the buccal cortical plate is usually thinner and the anaesthetic is closer to the tooth to be tested [22]. These facts might explain their discrepancies compared to the present study.

An important issue that needs to be considered is the choice of local anaesthetic. Articaine has a faster onset and better diffusion through bone than lidocaine [10,23]. For example, Corbett et al. [24] found different results regarding the time until the patient reported lip numbness, probably because the local anaesthetic was lidocaine. The longer onset time recorded in the present sample is probably related to the fact that the anaesthetic solution was delivered next to the buccal bone plate, which is especially thick in the posterior area of the mandible. Therefore, the anaesthetic solution takes longer to diffuse through the bone and reach the inferior alveolar nerve, in contrast with IANB, which places the solution in the area where the inferior alveolar nerve enters the mandibular canal. The INF group patients' buccal injection points (between the first and second molars) were slightly distal to those described by El-Kholey [13]. The available data on the success rates of other infiltration areas closer to the third molar region is scarce and comes from cohort studies that did not include a control group using IANB [5–7]. Thus, in our opinion, future research to determine the ideal injection point is needed, since this variable is likely to influence the anaesthetic success rate.

According to the present study, IANB is the most suitable technique since it significantly increased the anaesthetic

efficacy in approximately one fifth of cases (64.4 vs. 45.8%; $p < 0.05$) and reduced the onset time by one minute (179 vs. 116 s; $p < 0.05$) in comparison with the infiltration technique. Furthermore, IANB seems slightly to diminish the likelihood of early anaesthetic failures (1.7 vs. 10.2%; $p > 0.05$) and the need for reanesthesia during the procedure (34.5 vs. 49.1%; $p > 0.05$). Also, the fact that the INF group patients experienced more pain during the initial postoperative period might indicate that this technique provided less residual analgesia. This last issue might be particularly relevant in certain dental procedures in which postoperative pain is expected.

Both techniques proved safe and were without any relevant adverse effects. Even so, a larger volume of anaesthetic solution was employed in the INF group, which might increase the risk of systemic complications. The perception of pain during injection was also similar in both groups. Bataineh et al. [25] performed a split-mouth trial comparing IANB and infiltration techniques to assess the patient's perception of pain in extractions of lower first molars and found similar results regarding pain during injection [25].

One of the most severe complications of IANB is injury to the inferior alveolar and/or lingual nerves [1,2]. Fortunately, these injuries are rarely associated with IANB and the estimated incidence is extremely low [25,26]. Nevertheless, clinicians should take into consideration the possible medicolegal repercussions of these complications [27]. Several authors have discussed whether such lesions are associated with mechanical (needle) or chemical (anaesthetic solution) injury of the nerve. Some papers have suggested that prilocaine and articaine are more likely to produce nerve impairment after nerve blocks [28,29]. Hillerup et al. [30] considered that this issue is probably related to the concentration of articaine (4%), which, according to these authors, might be neurotoxic. According to another paper by the same group [31], however, sensory impairment following the use of articaine is estimated at 1 case out of 4.8 million. Nonetheless, these complications can have important repercussions for the patient's quality of life, particularly when neuropathic pain develops [32], and should therefore be avoided. The present results seem to support the literature concerning the higher vulnerability of the lingual nerve in comparison with the inferior alveolar nerve [1], since 7 of the IANB group patients experienced a sensation of electric discharge in the tongue, against 3 in the lower lip.

Infiltration techniques have the advantage of reducing the time and intensity of the postoperative lip and tongue numbness that can interfere with the patients' daily activities, thus preventing accidental self-inflicted injuries to the soft tissues. However, clinicians should bear in mind that IANB provides some important advantages, such as higher anaesthetic efficacy, a shorter onset time and less postoperative pain.

Conclusions

IANB with additional buccal infiltration is more suitable for achieving adequate analgesia in L3M extractions than the experimental technique (infiltration in the buccal and lingual areas). Moreover, the standard method is safe and provides a shorter onset time and lower initial postoperative pain levels. Additional randomised controlled clinical trials with large samples are required to confirm these findings.

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The authors would like to declare the following interests outside the work presented:

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