

Differences In The Onset Time Of Local Anesthesia Using 2% Lidocaine Hcl With 1:80,000 Adrenaline Between Smokers And Non-Smokers With Inferior Alveolar Nerve Block Anesthesia At The Oral Surgery Clinic Of The University Of Jember Dental And Oral Hospital

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Abstract

Background: Tooth extraction is a common dental procedure in Indonesia, but it often causes anxiety and pain in patients. Local anesthesia is the main solution to overcome this pain. Lidocaine HCl 2% with adrenaline is commonly used, but its effectiveness can be affected by various factors, including smoking habits. Cigarettes contain nicotine and other substances that have the potential to affect the pharmacokinetics and pharmacodynamics of anesthetic drugs, especially through their interaction with sodium channels and acceleration of drug metabolism.

Objective: This study aimed to determine the difference in the onset time of local anesthetic action of lidocaine HCl 2% with 1: 80,000 adrenaline (pehacain) in smokers and non-smokers.

Methods: comparing the onset time of anesthetic action of lidocaine HCl 2% with 1: 80,000 adrenaline in groups of smokers and non-smokers. Data were collected and analyzed using SPSS to identify significant differences between the two groups.

Results: A significant difference in the onset time of local anesthetic action was found between smokers and non-smokers. Smokers showed a slower onset time of anesthetic action than non-smokers. This is associated with nicotine's interaction with nicotinic acetylcholine receptors, which affects sodium channel activity and the acceleration of anesthetic drug metabolism due to smoking. However, no significant correlation was found between the number of cigarettes consumed per day and the onset time of local anesthetic action.

Conclusion: There is a significant effect between smoking habits and the onset time of local anesthetic action. Smokers experience a slower onset of anesthesia, indicating the need for special consideration in pain management in patients who smoke. must be 150 to 250 words. The paragraph must be written in 1 space and italic font

Keywords: Local anesthesia, smokers, anesthetic onset

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I. Introduction

Tooth extraction is a common medical procedure in Indonesia, although it should ideally be considered a last resort. The public's limited understanding of the importance of preserving natural teeth has resulted in extraction remaining a primary treatment option. According to the 2018 Basic Health Research in Indonesia, the prevalence of tooth extraction reached 7.8–8%, with the highest rate reported in East Java. This procedure often causes anxiety and pain, making local anesthesia an essential step in pain management.^[10, 14]

Lidocaine HCl 2% with the addition of adrenaline is a widely used local anesthetic because it is able to prolong the duration of action and reduce bleeding.^[5] However, its effectiveness may be influenced by smoking habits. Nicotine contained in cigarettes is known to alter sodium channel function and accelerate drug metabolism through the activation of cytochrome P450 enzymes, thereby potentially affecting the onset of anesthesia.^[6] This mechanism may result in smokers experiencing a delayed onset of anesthesia compared to non-smokers.^[3, 4]

Furthermore, smoking increases the risk of hypoxemia through the formation of carboxyhemoglobin, which reduces the oxygen-carrying capacity of hemoglobin. This condition may lower the patient's pain threshold and consequently influence the effectiveness of anesthesia. Previous studies have also demonstrated that the onset of spinal anesthesia is delayed in pregnant women who smoke compared to non-smokers.^[7] Based on this background, the present study was conducted to determine the difference in the onset of local anesthesia using

lidocaine HCl 2% with 1:80,000 adrenaline between smokers and non-smokers employing the inferior alveolar nerve block technique.

II. Method

This study was a clinical experimental investigation employing a post-test only group design, conducted at the Oral Surgery Clinic of the Dental and Oral Hospital, University of Jember, from March to June 2025. The study aimed to compare the onset time of local anesthesia using 2% lidocaine HCl with 1:80,000 adrenaline (pehacain) between smokers and non-smokers utilizing the inferior alveolar nerve block technique. The study subjects consisted of male and female patients aged 18–45 years who had an indication for extraction of mandibular posterior teeth and met the inclusion criteria, including the absence of systemic diseases such as diabetes mellitus, cardiovascular disease, acute respiratory infection, or a history of allergy to local anesthetics, and willingness to provide informed consent. The exclusion criteria included any condition that could interfere with the patient’s ability to comply adequately with the study procedures.

Sampling was performed using a purposive sampling technique, yielding a total of 56 subjects who were allocated into two groups: smokers and non-smokers, each consisting of 28 participants. In this study, smokers were defined as individuals who had actively smoked for at least the past six months. They were further categorized based on the type of cigarette (filter and non-filter) and daily cigarette consumption into light smokers (1–10 cigarettes/day), moderate smokers (11–20 cigarettes/day), and heavy smokers (>20 cigarettes/day). The anesthetic agent used was 2% lidocaine HCl with 1:80,000 adrenaline (pehacain), administered using the inferior alveolar nerve block technique by second- and third-year integrated clinical clerkship students under the supervision of a faculty advisor.

The study procedure commenced with patient history taking and a general clinical examination, followed by the administration of local anesthesia according to the standard technique. Upon completion of the injection, the onset time was measured using a stopwatch from the end of the injection until the patient reported a numb sensation in the lower lip, tongue, or mucosal area surrounding the anesthetized tooth. The onset of anesthesia was assessed subjectively through patient interviews and objectively by applying gentle pressure with a dental explorer to the target mucosal area. Anesthetic efficacy was considered achieved when the patient perceived pressure without pain.

The collected data were analyzed using SPSS software. Normality testing was performed using the Kolmogorov–Smirnov or Shapiro–Wilk test, depending on the sample size. Homogeneity of variance was assessed using Levene’s test. Comparisons between smokers and non-smokers were conducted using the Independent t-test when the data were normally distributed and homogeneous, while Two-Way ANOVA was employed to analyze the relationship between cigarette type and consumption level with the onset of local anesthesia. Statistical significance was set at $p < 0.05$.

III. Result

This study involved 56 subjects divided into two groups, namely smokers and non-smokers, with 28 participants in each group. All subjects underwent extraction of mandibular posterior teeth using the inferior alveolar nerve block technique with 2% lidocaine HCl containing 1:80,000 adrenaline (pehacain) as the local anesthetic agent

Tabel 1. Comparison Between the Smoker and Non-Smoker Groups

Variable	P-value	t
Onset Time of Anesthesia in Smokers and Non-Smokers	0,000	7,531

Note: *) *Independent t-test*, $p < 0,05$ was considered statistically significant

The results of the measurement of the onset time of local anesthesia using lidocaine HCl 2% with 1:80,000 adrenaline demonstrated a statistically significant difference between the two groups. The smoker group exhibited a longer mean onset time compared to the non-smoker group. Based on the Independent t-test analysis, this difference yielded a p-value of < 0.05 , indicating a statistically significant difference between the two groups.

Tabel 2. Comparison Between Filter and Non-Filter Cigarette Groups Based on the Number of Cigarettes Consumed

Variable	P-value
Cigarette Type	0,892
Number of Cigarettes	0,886
Type of Cigarette and Number of Cigarettes	0,549

Note: *) *Two-Way ANOVA*, $p < 0,05$ was considered statistically significant

Furthermore, additional analyses were conducted to evaluate the type of cigarette and the daily number of cigarettes consumed within the smoker group. Although a tendency was observed indicating that higher cigarette consumption was associated with a longer onset time of anesthesia, the Two-Way ANOVA analysis did not demonstrate a statistically significant relationship between the number of cigarettes consumed per day and the onset time of local anesthesia ($p > 0.05$).

Overall, the findings of this study indicate that smoking habits have a significant effect on prolonging the onset time of local anesthesia. However, neither the daily number of cigarettes consumed nor the type of cigarette was shown to produce a statistically significant difference in onset duration, suggesting that smoking itself serves as the primary determinant rather than variations in smoking behavior.

IV. Discussion

This study aimed to determine the difference in the onset of local anesthesia between smokers and non-smokers. The results of the comparative analysis demonstrated a statistically significant difference ($p < 0.05$), indicating that the smoker group exhibited a slower onset of anesthesia compared to the non-smoker group. This difference may be explained by various pharmacodynamic and pharmacokinetic mechanisms influenced by nicotine content in cigarettes.

Nicotine is the primary psychoactive compound in cigarettes and exerts its effects by activating nicotinic acetylcholine receptors (nAChRs). This activation opens ligand-gated ion channels, allowing the influx of sodium and calcium ions into nerve cells. Such effects may alter the function of sodium channels, which are also the primary targets of local anesthetics, thereby reducing anesthetic efficacy.^[2, 4] In addition, nicotine has been reported to induce lipolysis and increase circulating free fatty acid concentrations, which may inhibit the penetration of local anesthetics through the lipid-rich neuronal cell membrane.^[3]

From a pharmacokinetic perspective, cytochrome P450 (CYP450) enzyme activity is elevated in smokers, leading to accelerated drug metabolism. Consequently, plasma concentrations of the anesthetic agent may decline before reaching maximal effect, thereby prolonging the onset time and reducing anesthetic effectiveness.^[8, 11]

Nevertheless, the success of anesthesia is also influenced by other variables, such as the operator's proficiency in injection technique, as well as the patient's psychological condition, including anxiety and fear, which may modify pain perception.^[12] Furthermore, no significant differences were observed between cigarette types (filter and non-filter) or the number of cigarettes consumed per day with respect to onset time, which is most likely attributable to the relatively similar nicotine content between these cigarette types.^[15]

Overall, the findings of this study are consistent with several previous reports indicating that smoking may impair the effectiveness of local anesthesia and alter its pharmacodynamic properties, particularly through modulation of ion channel activity and changes in tissue physiology.^[1, 6] Although no significant clinical differences were identified between cigarette types, the chronic effects of nicotine exposure remain an important factor to consider in anesthetic planning, especially among smokers.

V. Conclusion

Based on the findings of this study, it can be concluded that there is a difference in the onset of local anesthesia using lidocaine HCl 2% with 1:80,000 adrenaline (pehacain) between smokers and non-smokers, with the smoker group demonstrating a slower anesthetic onset time compared to the non-smoker group.

References

- [1]. Al-Noori, N. M., Iraheem, N. S., & Abdulmunem, M. M. (2021). The Impact Of Cigarette Smoking On The Efficiency Of Local Anesthesia During Simple Tooth Extraction. *The Saudi Dental Journal*, 33(7), 674–678. <https://doi.org/10.1016/j.sdentj.2020.04.011>
- [2]. Benowitz, N. L. (2009). Pharmacology Of Nicotine: Addiction, Smoking-Induced Disease, And Therapeutics. *Annual Review Of Pharmacology And Toxicology*, 49, 57-71.
- [3]. Benowitz, N. L., & Burbank, A. D. (2016). Cardiovascular Toxicity Of Nicotine: Implications For Electronic Cigarette Use. *Trends In Cardiovascular Medicine*, 26(6), 515–523. <https://doi.org/10.1016/j.tcm.2016.03.001>
- [4]. Cobo, R., Nikolaeva-Koleva, M., Alberola-Die, A., Fernández-Ballester, G., González-Ros, J. M., Ivorra, I., & Morales, A. (2020). Mechanisms Of Blockade Of The Muscle-Type Nicotinic Receptor By Benzocaine, A Permanently Uncharged Local Anesthetic. *Neuroscience*, 439, 62-79.
- [5]. Dewi, K. K., Kusparmanto, L., & Setyanti, D. K. P. (2022). Pengaruh Zat Vasokonstriktor Dalam Larutan Anestesi Lokal Terhadap Tekanan Darah Pada Pasien Pencabutan Gigi. *M-Dental Education And Research Journal*, 2(1), 08-16.
- [6]. Fawwaz, S. M., & Pardede, D. K. B. (2023). Dampak Kebiasaan Merokok Terhadap Risiko Anestesi Dan Pembedahan. *Cermin Dunia Kedokteran*, 50(10), 576-580.
- [7]. Güneş, H. Y., Çalışkan, D. K., Sakar, H. A., & Yüzkat, N. (2022). Does Smoking Affect The Onset Time Of Sensory Blocks Or The Duration Of Motor Blocks In Parturient Women? A Randomized Controlled Trial. *Nigerian Journal Of Clinical Practice*, 25(12), 2039-2045.
- [8]. Herdwiani, Wiwin, Jason Merari Perangiangan Dan Lucia Vita Inandha Dewi. (2021). *Buku Ajar Farmakokinetik Klinik*. Jakarta: Trans Info Media.
- [9]. Kamadjaja, David B.. (2019). *Anestesi Lokal Di Rongga Mulut Prosedur, Problema, Dan Solusinya*. Surabaya: Unair Press.

- [10]. Kemenkes, R. I. (2018). Hasil Utama Riset Kesehatan Dasar (Riskesdas) 2018. Jakarta: Kementerian Kesehatan Republik Indonesia Badan Penelitian Dan Pengembangan Kesehatan
- [11]. Lestari, Bayu, Dkk. (2017). Farmakologi Dasar. Malang: UB PRESS.
- [12]. Prasetyo, E. P. (2005). Peran Musik Sebagai Fasilitas Dalam Praktek Dokter Gigi Untuk Mengurangi Kecemasan Pasien. Majalah Kedokteran Gigi, 38, 41-44.
- [13]. Priyoto. (2015). Perubahan Dalam Perilaku Kesehatan; Konsep Dan Aplikasi. Yogyakarta: Graha Ilmu.
- [14]. Sitanaya, R. (2016). Exodontia (Dasar-Dasar Ilmu Pencabutan Gigi). Deepublish.
- [15]. Tobacco Tactics, Cigarette Filters, Updated 23 April 2025, Di Akses Pada 01 July 2025.