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Comparative Assessment of the Effects of Three Local Anesthetics: Lidocaine, Prilocaine, and Mepivacaine on Blood Pressure Changes in Patients with Controlled Hypertension

Seyyed Hamed Jalalian Hashemi[1], Shamsodin Rigi Ladez[2] & Somaye Ansari Moghadam[1]

[1] Oral and Dental Disease Research Center, Zahedan University of Medical Sciences, Zahedan, Iran

[2] Zahedan University of Medical Sciences, Zahedan, Iran

Correspondence: Somaye Ansari Moghadam, Oral and Dental Disease Research Center, School of Dentistry, Zahedan University of Medical Sciences, Zahedan, Iran. E-mail: s_a_moghadam@yahoo.com

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Abstract

Background: Given large number of patients with hypertension attending dental clinics and the profound effects of local anesthetics containing vasoconstrictors, this study aimed to compare the effects of lidocaine 2% + epinephrine, prilocaine 3% + felypressin0.03, and mepivacaine 3% on blood pressure changes.

Methods: The current study was carried out from May 2014 to February 2015.Patients with controlled hypertension (systolic blood pressure<159.94 mmHg before the injection) who attended Zahedan dental school (Zahedan , Iran) for the extraction of a mandibular tooth were selected and randomly allocated to three groups of 20. Groups 1-3 received lidocaine 2% + epinephrine, prilocaine 3% + felypressin 0.03 units, and mepivacaine3%, respectively. Patients were only included if they were injected with a maximum of two 1.8 ml cartridges (3.6 ml) for tooth extraction (maximum epinephrine dose of 0.04 mg was maintained in systemic patients).The collected data were analyzed using the analysis of variance (ANOVA) in SPSS 19.0. (SPSS Inc., Chicago, IL, USA)

Results: No significant differences were observed between the systolic and diastolic blood pressure of the three groups. The three evaluated local anesthetic solutions had similar effects in patients with controlled hypertension.

Conclusion: While no significant changes in blood pressure were observed in three groups, all dental procedures on the mentioned group of patients have to be performed under careful monitoring and aspiration. Moreover, the maximum epinephrine dose (0.04mg) should never be exceeded in these patients.

Keywords: diastolic blood pressure, hypertension, local anesthetic, systolic blood pressure, vasoconstrictor

1. Introduction

Supplementing local anesthetics with a vasoconstrictor (epinephrine or adrenaline) will promote the success of anesthesia by increasing its depth and duration and facilitating homeostasis (Jastak & Yagield, 1983). Vasoconstrictors also maintain the anesthetics within the injection site and reduce the risk of their systemic effects (Lioyd-Jones et al., 2010).

Hypertension is defined as systolic and diastolic blood pressures greater than 140 and 90 mmHg, respectively (Jennings, 2015). Individuals receiving antihypertensive treatments are also called hypertensive even if they have controlled blood pressure (Lioyd-Jones et al., 2010). The administration of epinephrine in hypertensive patients is associated with an increased risk (Bader, Bonito, & Shugars, 2002), as it can elevate the already raised systolic blood pressure and cause acute hypertensive crisis, hypertensive encephalopathy, brain hemorrhage, and acute left ventricular failure(Lioyd-Jones et al., 2010).

Moreover, since chronic hypertension leads to cardiac hypertrophy and atherosclerosis, epinephrine-induced elevations in blood pressure and heart rate may overload the heart and result in angina pectoris, heart attack, and cardiac arrhythmias (Lioyd-Jones et al., 2010). Also, the administration of epinephrine in patients receiving non-selective beta-blockers for the treatment of hypertension can result in hypertensive crisis, since the beta-blocker, block the beta 2 adrenergic receptor and prevents the vasodilation activity of epinephrine. The use of epinephrine in hypertensive patients using diuretics and calcium channel blockers can also cause hypokalemia

and arrhythmia (Lioyd-Jones et al., 2010).

Despite controversies over the administration of epinephrine for hypertensive patients in dental clinics (Bader et al., 2002), a number of researchers have recommended its safety at permissible doses (Torres-Lagares et al., 2012; Silvestre, Salvador-Martinez, Bautista, & Silvestre-Rangil, 2011; Ezmek, Asra, Delibasi, & Sencift, 2010; Elad et al., 2008; Niwa, Sugimura, Satoh, & Tanimoto, 2001). On the other hand, even though epinephrine generally contraindicated in ASA III&IV hypertensive patients, and those with blood pressure above 200/115 mmHg (Hupp, Ellis, & Tcker, 2008), but many dentists try to replace the routine lidocaine-epinephrine combination with alternative anesthetics in the treatment of patients with a history of hypertension.

Lidocaine with epinephrine may be the most common local anesthetic used by dentist. In fact, Lidocaine is regarded as the gold standard (R. J. Vasconcellos, B. C. Vasconcellos, & Genu, 2008) against which all new local anesthetics are assessed. Currently, the prilocaine-felypressin combination and mepivacaine are used as alternatives to lidocaine with epinephrine. However prilocaine has potential to cause methemoglobinemia and increase the risk of paresthesia (Doko et al., 2010). Mepivacaine, on the other hand is a short acting anesthetic, although there are controversy. (Berberich, Reader, Drum Nusstein, & Beck, 2009; Ding, Zhu, Wu, & Cao, 2008)

Uzeda examined systolic and diastolic blood pressure changes in healthy patients and those with controlled blood pressure presenting for dental extraction and receiving local anesthetics with vasoconstrictors. The patients were examined in the waiting room, when entering the surgery room and ten minutes after the injection. Systolic blood pressure was found to be lower in the healthy patients than those with controlled blood pressure during all the time points. Diastolic blood pressure, however, was lower in the healthy patients than those with controlled blood pressure only during the period in the waiting room (Uzeda, Moura, Louro, da Silva, & Calasans-Maia, 2014).

De Morias examined the effect of lidocaine and articaine as anesthetics on systolic and diastolic blood pressure in patients with controlled blood pressure before, immediately after and five minutes after injection and observed that the type of anesthetics used has no effects on systolic and diastolic blood pressure (de Morias et al., 2012).

Some authors believe that the dose of epinephrine entering the patient's blood flow through the injection of anesthetics is less than the amount of endogenous epinephrine produced in response to stress and to the pain caused by insufficient anesthetics (Uzeda et al., 2014). Moreover, the use of anesthetic solutions lacking vasoconstrictors might increase the risk of cardiac diseases due to the potential pain caused by insufficient anesthesia. (Ezmek et al., 2010; Bortoluzzi, Manfro, & Nardi, 2010; Conardo et al., 2007)

Lidocaine is one of the most commonly used anesthetics that has good pharmacokinetics and a lower toxicity compared to other amidic anesthetics and is therefore appropriate for use in dental procedures (de Morias et al., 2012). Although the use of two 1.8 mg cartridges of local anesthetics containing 1:100,000epinephrine in patients with controlled blood pressure and those with mild blood pressure (ASA I, i.e. lower than 159/99) has been reported to be safe (Bader et al., 2002; Chaudhry et al., 2011), many dentists still avoid the administration of local anesthetics containing vasoconstrictors for patients with high or controlled blood pressure. For this reason, and also due to the inconsistencies in the findings of previous studies, this study aimed to compare changes in blood pressure following the administration of anesthetics containing epinephrine with mepivacaine and prilocaine in patients with controlled hypertension.

2. Materials and Methods

This clinical trial study was conducted from 21 May 2014 to 10 January 2015, after obtaining the required approval from the Ethics Committee of Zahedan University of Medical Sciences (#6268). The present study was double-blind in design, as both the patients and the person in charge of measuring their blood pressure were unaware of the type of anesthetics used. Given α=0.05 and β=0.09, the study sample size was calculated as 60. The participants were selected from patients with controlled hypertension (systolic blood pressure below 159.94 mmHg) who presented at Zahedan Dental School, for tooth extraction. The patients were enrolled if they required inferior alveolar nerve block and did not suffer from untreated hyperthyroidism or diabetes mellitus, sulfite-sensitive asthma, or sulfite allergy. Pregnant and breast-feeding women as well as patients with cardiovascular diseases, such as unstable angina, myocardial infarction and cerebrovascular accident (in the past six months), uncontrolled cardiac arrhythmia, and decompensated congestive heart failure, were not included. Inform consent was taken from all patients.

A total of 60 patients were selected and allocated to three equal groups with convenience sampling method. Groups 1-3 received Persocaine solution (lidocaine 2% with epinephrine 1/80000; Darupakhsh Pharmaceutical Co, Iran), Dentanest solution (prilocaine 3% with 0.03 units felypressin; Daru Pakhsh Pharmaceutical Co, Iran),

Scandinibsa solution (mepivacaine 3%; Inibsa Laboratories, Spain), respectively. Patients were only included if their tooth extraction required two 1.8 ml cartridges (maximum epinephrine dose of 0.04 mg). Patients were asked to sit on the dental chair where they were maintained in a semi-supine position with their left arm parallel to their body and the blood pressure cuff leveled with their heart (for precise measurement). A pulse oximetry device was used to measure and record blood pressure on three times, namely before the injection and after five minutes rest in the dental chair (stage1), immediately after injection of the second cartridge(stage 2), and five minutes after the second injection (stage 3) by a dentistry student under supervision of oral and maxillofacial surgeon. The collected data were analyzed using the analysis of variance (ANOVA) in SPSS 19.0. (SPSS Inc., Chicago, IL, USA) for studying of the local anesthetics effects on systolic and diastolic blood pressure

3. Results

The participants aged 34-85 years old and had a mean age of 56.6 ± 11.7 years (Table 1)

Table 1. Frequency distribution of the participants' age

Age range	N(%)
34-50 years	24(40%)
50-70 years	33(55%)
70-85 years	3(5%)

Blood pressure analyses showed that the mean systolic blood pressure for all three anesthetics was higher immediately after the injection as compared the other two times .The values before the injection were also higher than those five minutes after the injection.

Accordingly, anesthetic injections generally reduce systolic blood pressure. There were no significant differences between the mean systolic blood pressure of the three groups at any stages (Table2).

Table 2. Comparison of the patients' means systolic blood pressure (SBP) before, immediately after and five minutes after the injection of anesthetic

Time	Anesthetic	SBP(mmHg)	P
Before the injection	Lidocaine 2%, epinephrine 1/80000	141.05± 11.09	0.97
	Prilocaine 3%,felypressin0.03	140.25±14.41	
	Mepivacaine3%	141.5±12.61	
Immediately after the injection	Lidocaine 2%, epinephrine 1/80000	146.60±18.73	0.93
	Prilocaine 3%,felypressin0.03	144.51±18.60	
	Mepivacaine3%	145.75±13.19	
Five minutes after the injection	Lidocaine 2%, epinephrine 1/80000	138.00 ±15.94	0.58
	Prilocaine 3%,felypressin0.03	137.01±27.24	
	Mepivacaine3%	143.4±16.9	

P obtained from ANOVA

At all times, the patients who received mepivacaine had higher mean diastolic blood pressure compared to the other two groups. However, no significant differences in the diastolic blood pressure were observed between the three groups at any stages (Table3).

Table 3. Comparison of the patients' means diastolic blood pressure (DBP) before, immediately after and five minutes after the injection of anesthetic.

Time	Anesthetic	DBP(mmHg)	P
Before the injection	Lidocaine 2%, epinephrine 1/80000	82.80±10.19	0.97
	Prilocaine 3%,felypressin0.03	84.45±11.21	
	Mepivacaine3%	86.90±10.25	

	Lidocaine 2%, epinephrine 1/80000	82.25±11.21	
Immediately after the injection	Prilocaine 3%,felypressin0.03	88.20±16.21	0.93
	Mepivacaine3%	89.41±11.64	
	Lidocaine 2%, epinephrine 1/80000	80.00±8.85	
Five minutes after the injection	Prilocaine 3%,felypressin0.03	86.50±14.20	0.58
	Mepivacaine3%	88.11±13.36	

P obtained from ANOVA

4. Discussion

The combination of lidocaine and epinephrine is currently the most widely used anesthetic in dentistry. Epinephrine is a sympathomimetic catecholamine which is believed to increase (both systolic and diastolic) blood pressure. Research on the effects of epinephrine-containing solutions on blood pressure has reported these solutions to have no particular clinical side effects in healthy people (Conrado et al., 2007; Meral et al., 2005; Degerliyurt & Denizci, 2013; de Morias, de Santanastos, de Costa Araujo, Vajgel, & de Holanda Vascouncellos, 2012; de Morais et al., 2012; Akutsu, Chiba, Takahashi, Shimoda, & Suematsu, 1964).

Although a large number of patients attending dental clinics have hypertension, few studies have evaluated the effects of vasoconstrictor-containing anesthetics on hypertensive patients. This highlights the need for clinical studies, like the present study, in this field.

According to the statement published by American Dental Association (ADA) and American Heart Association (AHA) in 1964, local anesthetic solutions containing normal concentrations of vasoconstrictors are not contraindicated in cardiovascular patients, if careful monitoring and aspiration is performed during the intended dental procedures (Akutsu et al, 1964). However, they are not state the maximum dose of vasoconstrictors in the cardiovascular patients and it may still be associated with risks (Abraham-Inpijn, Borgmeijer-Hoelen, & Gortzak, 1998). Malamed recommended a maximum epinephrine dosage of 0.04 mg/session for severe cardiovascular patients (Malamed, 2008). Also, we use this dose.

Nevertheless, due to their traditional beliefs, dentists interested that ignored these documented base lines and tend to use alternative anesthetic solutions, as prilocaine-felypressin, for patients named with hypertension. Although felypressin has not systemic effects of epinephrine; it has some cardiovascular effects (Bronzo, Cardoso, Ortega, & Mion, 2012). Prilocaine has also been found to have a number of side effects including methemoglobinemia (Doko et al., 2010). Another alternative is mepivacaine, which has not a vasoconstrictor and thus has shorter anesthetic effects probably (Barberich et al., 2009; Ding et al., 2012).

The criteria that used in various studies for cardiovascular patients were different. Torres-lagares et al were studied hypertensive patients (Torres Lagares et al., 2012). In conrado et al study, all were heart failure cases. (Conrado et al, 2007)

Elad et al. (2008) enrolled patients with controlled hypertension, but did not mentioned the presence of others cardiovascular diseases of their participants. The participants in the present study only had controlled hypertension and no other cardiovascular diseases.

In this study, changes caused by epinephrine in the systolic and diastolic blood pressure of the participants were not significantly different from those caused by the other two anesthetics. However an increase in systolic blood pressure was detected immediately after epinephrine injection, attributed such an increase to the stress-induced release of excessive endogenous catecholamine's, as Niwa et al mentioned in their study (Niwa et al., 2001). In fact, since the epinephrine concentration induced by exogenous resources peaks three-five minutes after the injection, the observed elevation is not a pharmacological effect (Lipp, Dick, Daublander, Fuder, & Stanton Hicks, 1993).

Ezmek et al. (2010) and Torres Lagares et al. (2012) did not report a significant difference between the hemodynamic effects of the three examined anesthetics; moreover, both the present research and the study conducted by Torres-Lagares et al. (2012) indicated the greatest increase in diastolic blood pressure occurred following mepivacaine administration. Further studies are undoubtedly required to confirm this finding. In contrast, Ding et al. (2008) found that lidocaine and mepivacaine to cause significantly different changes in diastolic blood pressure and heart rate. This study same as de Morias assessed patients before, immediately after and five minutes after the injection of the anesthetics (de Morias et al., 2012). Although examining the long-term effects of local anesthetics on patients with conditions such as arrhythmia is also helpful, the present study did

not pursue it due to the patients' lack of cooperation, which may comprise one of the limitations of the study and is recommended to be further examined in future studies.

5. Conclusion

The three evaluated local anesthetic solutions (lidocaine 2% + epinephrine 1/80000, prilocaine 3% + felypressin 0.03, and mepivacaine 3%), had similar effects in patients with controlled hypertension .While no significant changes in blood pressure were observed in any of the groups, all dental procedures on the mentioned group of patients have to be performed under careful monitoring and aspiration. Moreover, the maximum epinephrine dose (0.04 mg) should never be exceeded in these patients.

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Conflict of Interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

References

Abraham-Inpijn, L., Borgmeijer-Hoelen, A., & Gortzak, R. T. (1988). Changes in blood pressure, heart rate, and electrocardiogram during dental treatment with use of local anesthesia. *J Am Dent Assoc, 116*(4), 531-536. http://dx.doi.org/10.14219/jada.archive.1988.0318

Akutsu, A., Chiba, T., Takahashi, H., Shimoda, M., & Suematsu, T. (1964). Management of dental problems in patients with cardiovascular disease. *J Am Dent Assoc, 68*, 333-342. http://dx.doi.org/10.14219/jada.archive.1964.0104

Bader, J. D., Bonito, A. J., & Shugars, D. A. (2002). A systematic review of cardiovascular effects of epinephrine on hypertensive dental patients. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod, 93*(6), 647-653. http://dx.doi.org/10.1067/moe.2002.123866

Berberich, G., Reader, A., Drum, M., Nusstein, J., & Beck, M. (2009). A prospective, randomized, double-blind comparison of the anesthetic 1:50,000 epinephrine and three percent mepivacaine in the intraoral, infraorbital nerve block. *J Endod, 35*(11), 1498-504. http://dx.doi.org/10.1016/j.joen.2009.08.007

Bortoluzzi, M. C., Manfro, R., & Nardi, A. (2010). Glucose levels and hemodynamic changes in patients submitted to routine dental treatment with and without local anesthesia. *Clinics, 65*(10), 975-978. http://dx.doi.org/10.1590/S1807-59322010001000009

Bronzo, A. L., Cardoso, C. G., Ortega, K. C., & Mion, D. (2012). Felypressin increases blood pressure during dental procedures in hypertensive patients. *Arq Bras Cardiol, 2*, 724-731. http://dx.doi.org/10.1590/S0066-782X2012005000062

Chaudhry, S., Iqbal, H. A., Izhar, F., Mirza, K. M., Khan, N. F., Yasmeen, R., & Khan, A. A. (2011). Effect on blood pressure and pulse rate after administration of an epinephrine containing dental local anesthetic in hypertensive patients. *J Pak Med Assoc, 61*, 1088-1091.

Conrado, V. C., Andrade, J. D., de Angelis, G. A., Andrade, A. C. P. D., Timerman, L., Andrade, M. M., ... & Piegas, L. S. (2007). Cardiovascular effects of local anesthesia with vasoconstrictor during dental extraction in coronary patients. *Arq Bras Cardiol, 88*(5), 507-513. http://dx.doi.org/10.1590/S0066-782X2007000500002

de Morais, H. H., de Santana Santos, T., de Costa Araujo, F. A.,Vajgel, A., & de Holanda Vasconcellos, R. J. (2012). Hemodynamic changes comparing lidocaine HCI with eoinephrine and articaine HCI with epinephrine. *J Craniofac Surg, 23*(6), 1703-1708. http://dx.doi.org/10.1097/SCS.0b013e31826bec3b

de Morias, H. H., de Santana Santos,T., de Costa Araujo, F.,Vajgel, A., & de Holanda Vasconcellos, R. J. (2012). Hemodynamic changes comaring 2% lidocaine and 4% articaine with epinephrine1:100,000 in lower third molar surgery. *J Craniofac Surg, 23*(4), 1204-11. http://dx.doi.org/10.1097/SCS.0b013e31824f66a0

Degerliyurt, K., & Denizci, S. (2013). Does the topical use of epinephrine for sinus floor angmentationaffect systemic hemodynamics? *Implant Dent, 22*(3), 289-94. http://dx.doi.org/10.1097/ID.0b013e318289e2df

Ding, S., Zhu, Y. Q., Wu, Y. N., & Cao, D. (2008). Efficacy and safety of 3% rmepivacaine hydrochloride injection for oral local anesthesia. *Shanghai Kou Qiang Yi Xue, 17*(3), 328-331.

Doko, Y., Iranami, H., Fujii, K., Yamazaki, A., Shimogai, M., Hatano, Y. (2010). Severe methemoglobinemia

after dental anesthesia: A warning about propitocaine-induced methemoglobinemia in neonates. *J Anesth, 24*, 935-937. http://dx.doi.org/10.1007/s00540-010-1004-4

Elad, S., Admon, D., Kedmi, M., Naveh, E., Benzki, E., Ayalon, S., & Kaufman, E. (2008). The cardiovascular effect of local anesthesia with articaine plus 1: 200,000 adrenalin versus lidocaine plus 1:100,000 adrenalin in medically compromised cardiac patients: A prospective, randomized, double blinded study. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod, 105*(6), 725-730. http://dx.doi.org/10.1016/j.tripleo.2008.02.005

Ezmek, B., Arsan, A., Delibasi, C., & Sencift, K. (2010). Comparison of hemodynamic effects of lidocaine, prilocaine and mepivacaine solutions without vasoconstrictor in hypertensive patients. *J Appl Oral Sci, 18*(4), 354-359. http://dx.doi.org/10.1590/S1678-77572010000400006

Hupp, R., Ellis III., E., & Tucker, R. (2008). *Contemporary oral and maxillofacial surgery* (5th ed., chap l. 14).

Jastak, J. T., & Yagield, J. A. (1983). Vasoconstrictors and local anesthesia: A review and rational for use. *J Am Dent Assoc, 107*, 623-630. http://dx.doi.org/10.14219/jada.archive.1983.0307

Jennings, G. L. (2015). A New Guideline on Treatment of Hypertension in Those with Coronary Artery Disease: Scientific Statement from the American Heart Association, American College of Cardiology, and American Society of Hypertension about Treatment of Hypertension in Patients with Coronary Artery Disease. *Heart, Lung and Circ, 24*(11), 1037-40. http://dx.doi.org/10.1016/j.hlc.2015.05.022

Lioyd-Jones, D., Adams, R. J., Brown, T. M., Carnethon, M., Dai, S. F., De Simone, G., & Wylie-Rosett, J. (2010). Executive summary. Heart disease and stroke statistics update: A report from the American Heart Association. *Circulation, 121*(7), e46-e215. http://dx.doi.org/10.1161/CIRCULATIONAHA.109.192667

Lipp, M., Dick, W., Daublander, M., Fuder, H., & Stanton-Hicks, M. (1993). Exogenous and endogenous plasma levels of epinephrine during dental treatment under local anesthesia. *Reg Anesth, 18*, 6-12.

Malamed, S. F. (2004). *Local Anesthetia, 4*, 68.

Meral, G., Tasar, F., Sayin, F., Saysel, M., Kir, S., & Karabulut, M. (2005). Effects of lidcaine with and without epinephrine on plasma epinephrine and lidocaine concentrations and hemodynamic values during third molar surgery. *Oral Surg Oral Med Oral pathol Oral Radiol Endod, 100*(2), e25-e30. http://dx.doi.org/10.1016/j.tripleo.2005.03.031

Niwa, H., Sugimura, M., Satoh, Y., & Tanimoto, A. (2001). Cardiovascular response to epinephrine-containing local anesthesia in patients with cardiovascular disease. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod, 92*(6), 610-616. http://dx.doi.org/10.1067/moe.2001.118903

Silvestre, F. J., Salvador-Martinez, I., Bautista, D., & Silvestre-Rangil, J. (2011). Clinial study of hemodynamic changes during extraction in controlled hypertensive patients. *Med Oral Patol Oral Bucal, 16*(3), e354-358. http://dx.doi.org/10.4317/medoral.16.e354

Torres-Lagares, D., Serra-Figallo, M. A., Machuca-portillo, G., Corcuera Flores, J. R., Machuca-Portillo, C., Castillo-Oyague, R., & Gutterez-Perez, J. L. (2012). Cardiovascular effect of dental anesthesia with articaine (40 mg with epinephrine 0,5 mg % and 40 mg with epinephrine 1 mg%) versus mepivacaine (30 mg and 20 mg with epinephrine 1 mg%) in medically compromised cardiac patients: A cross-over, randomized, single blinded study. *Med Oral Patol Oral Cir Bucal, 17*(4), e655-660. http://dx.doi.org/10.4317/medoral.17892

Uzeda, M. J., Moura, B., Louro, R. S., da Silva, L. E., & Calasans-Maia, M. D. (2014). A randomized controlled clinical trial to evaluate blood pressure changes in patients undergoing extraction under local anesthesia with vasopressor use. *J Craniofac Surg, 25*(3), 1108-1110. http://dx.doi.org/10.1097/SCS.0000000000000736

Vasconcellos, R. J., Vasconcellos, B. C., & Genu, P. R. (2008). Influence of local anesthethics with adrenalina 1:100.000 in basic vital constants during third molar surgery. *Med Oral Patol Oral Cir Bucal, 13*(7), E431-437.

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