ว.ศัลย์ช่องปาก-แม็กซิลโลเฟเชียล ปีที่ 30 หน้า 134-141, พ.ศ.2559

นิพนธ์ต้นฉบับ

Original Article

การเปรียบเทียบประสิทธิผลของยาชาอาร์ติเคนร้อยละ 4 ผสมเอพิเนฟริน 1:100,000 และลิโดเคนร้อยละ 2 ผสมเอพิเนฟริน 1:100,000 โดยวิธีสกัดประสาทแอนทีเรียร์มิดเดิลซูพีเรียร์อัลวีโอลาร์

The efficacy of the anterior middle superior alveolar injection, comparing 4% articaine with 1:100,000 epinephrine and 2% lidocaine with 1:100,000 epinephrine

กาญจนา สิงขโรทัย[1] รพีพร มลังไพศรพณ์[1] ณภาภัช ปิยะศิริเดช[2]
ศศิวรรณ กรีพานิช[2] สุเมธี พัฒนกิจดำรงค์[2] บุณยนุช คงศิริ[2] รัตติยา นริสศิริกุล[2]
Kanjana Singkharotai[1] Rapeeporn Malungpaishrope[1] Napapatch Piyasiridej[2]
Sasiwan Kreepanich[2] Sumete Pattanakitdamrong[2] Bunyanuch Kongsiri[2] Rattiya Narissirikul[2]

[1]อาจารย์ [2]นักศึกษาทันตแพทย์ คณะทันตแพทยศาสตร์ มหาวิทยาลัยรังสิต
52/347 ต.หลักหก อ.เมือง จ.ปทุมธานี 12000
[1]Lecturer [2]Dental student, Faculty of Dental Medicine, Rangsit University
52/347 Lakhok, Mueang Pathum Thani District, PathumThani 12000, Thailand

บทคัดย่อ

วัตถุประสงค์ : **เพื่อเปรียบเทียบประสิทธิผลของยาชาอาร์ติเคนความเข้มข้นร้อยละ 4 ผสมเอพิเนฟริน 1:100,000 และยาชาลิโดเคนความเข้มข้นร้อยละ 2 ผสมเอพิเนฟริน 1:100,000 โดยวิธีสกัดประสาทแอนทีเรียร์มิดเดิลซูพีเรียร์อัลวีโอลาร์**

วิธีการศึกษา : **ผู้เข้าร่วมวิจัย 33 คน เป็นนักศึกษาชั้นปีที่ 1-6 คณะทันตแพทยศาสตร์ มหาวิทยาลัยรังสิต อายุระหว่าง 21-25 ปี ผู้เข้าร่วมวิจัยจะได้รับการฉีดยาชาโดยวิธีสกัดประสาทแอนทีเรียร์มิดเดิลซูพีเรียร์อัลวีโอลาร์ 2 ครั้ง ในด้านเดียวกันโดยฉีดห่างกันอย่างน้อย 2 สัปดาห์ โดยจะเลือกยาชาอาร์ติเคนความเข้มข้นร้อยละ 4 ผสมเอพิเนฟริน 1:100,000 และยาชาลิโดเคนความเข้มข้นร้อยละ 2 ผสมเอพิเนฟริน 1:100,000 ปริมาณ 0.9 มล. จากตารางสุ่มแบบง่าย แล้ววัดความสำเร็จของการชา การเริ่มต้นการชา และระยะเวลาการชา ซึ่งดูจากการตอบสนองต่อเครื่องทดสอบความมีชีวิตของเนื้อเยื่อในด้วยไฟฟ้า**

Corresponding author : กาญจนา สิงขโรทัย
คณะทันตแพทยศาสตร์ มหาวิทยาลัยรังสิต 52/347 ต.หลักหก อ.เมือง ปทุมธานี 12000
โทร. 08-1806-9286
E-mail address : kanjanadent@yahoo.com, kanjana.s@rsu.ac.th

ผลการศึกษา : ผลสำเร็จของการชาของยาชาอาร์ติเคนอยู่ระหว่างร้อยละ 60.6–97.0 และยาชาลิโดเคนอยู่ระหว่างร้อยละ 24.2–63.6 แตกต่างกันอย่างมีนัยสำคัญทางสถิติ (McNemar's test; $p < 0.05$) การเริ่มต้นการชาของยาชาอาร์ติเคนอยู่ในช่วง 3.45 ± 1.34 ถึง 5.30 ± 1.87 นาที ส่วนของยาชาลิโดเคนอยู่ในช่วง 3.40 ± 1.39 ถึง 6.75 ± 2.60 นาที ซึ่งไม่แตกต่างกันอย่างมีนัยสำคัญทางสถิติ (t-test; $p > 0.05$) ระยะเวลาการชาของยาชาอาร์ติเคนเท่ากับ 45.25 ± 30.07 ถึง 61.00 ± 42.90 นาที ส่วนของยาชาลิโดเคนเท่ากับ 20.63 ± 16.35 ถึง 41.25 ± 28.69 นาที พบว่าฟันทุกซี่ยกเว้นฟันกรามน้อยซี่ที่หนึ่งมีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ (t-test; $p < 0.05$)

สรุป : ในการสกัดประสาทแอนทีเรียร์มิดเดิลซูพีเรียร์อัลวีโอลาร์ ยาชาอาร์ติเคนความเข้มข้นร้อยละ 4 ผสมเอพิเนฟริน 1:100,000 มีผลสำเร็จของการชามากกว่าและระยะเวลาการชานานกว่ายาชาลิโดเคนความเข้มข้นร้อยละ 2 ผสมเอพิเนฟริน 1:100,000 จึงสรุปได้ว่ายาชาอาร์ติเคนความเข้มข้นร้อยละ 4 ผสมเอพิเนฟริน 1:100,000 มีประสิทธิผลดีกว่ายาชาลิโดเคนความเข้มข้นร้อยละ 2 ผสมเอพิเนฟริน 1:100,000

คำสำคัญ : วิธีสกัดประสาทแอนทีเรียร์มิดเดิลซูพีเรียร์อัลวีโอลาร์, อาร์ติเคน, ลิโดเคน

Abstract

Objective : to compare the efficacy of 4% articaine with 1:100,000 epinephrine and 2% lidocaine with 1:100,000 epinephrine when used for the anterior middle superior alveolar (AMSA) injection.

Materials and methods : the study included 33 first to sixth year dental students of Rangsit University, age between 21–25 years old. Each subject received 2 times of AMSA injections at the same site with at least 2-week interval between injections. The 0.9 ml of 4% articaine with 1:100,000 epinephrine and 2% lidocaine with 1:100,000 epinephrine were randomly used in this study. The response to the electrical pulp testing was recorded to determine anesthetic success, onset and duration.

Results : the anesthetic success of the AMSA injection ranged from 60.6 to 97.0% for articaine, and 24.2 to 63.6% for lidocaine, with statistically significant difference (McNemar's test; $p < 0.05$). The onset of pulpal anesthesia ranged from 3.45 ± 1.34 to 5.30 ± 1.87 minutes for articaine, and 3.40 ± 1.39 to 6.75 ± 2.60 minutes for lidocaine, with no statistically significant difference (t-test; $p > 0.05$). The duration of pulpal anesthesia ranged from 45.25 ± 30.07 to 61.00 ± 42.90 minutes for articaine, and 20.63 ± 16.35 to 41.25 ± 28.69 minutes for lidocaine. For most of the teeth, except the first premolars, there was statistically significant difference (t-test; $p < 0.05$) in duration between the two anesthetic solutions.

Conclusion : the AMSA injection using 4% articaine with 1:100,000 epinephrine had higher success rate and longer duration than those using 2% lidocaine with 1:100,000 epinephrine. Therefore, 4% articaine with 1:100,000 epinephrine had more efficacy than 2% lidocaine with 1:100,000 epinephrine.

Keywords : AMSA injection, articaine, lidocaine

Introduction

The anterior middle superior alveolar (AMSA) injection is a technique that provides anesthesia to multiple maxillary teeth with a single injection. The AMSA injection derives its name from the supposedly anesthesia of the AMSA nerves due to diffusion of the anesthetic solution from the palatal process of the maxillary bone towards the subneural dental plexus to envelope anterior superior alveolar and middle superior alveolar nerves at the apical region of the premolars via numerous nutrient canals.[1] Therefore all nerve branches that supply central incisors to premolars teeth will be anesthetized with single AMSA injection without collateral anesthesia of the face and muscles of facial expression.

This injection technique was the first reported by Friedman and Hochman in 1998 by using computer-controlled local anesthetic delivery (CCLAD) system which aids in the atraumatic administration of this injection. The AMSA injection site is located at a point that bisects the maxillary first and second premolar and midway between the crest of the free gingival margin and the midpalatine suture. The needle bevel was located against the mucosa and was oriented at an angle of 45°. The needle was inserted very slowly into the tissue to establish contact with the palatal bone with small amount of anesthetic volumes.[1]

Fukayama et al.[2] evaluated the anesthetic efficacy of the AMSA injection using the Wand method. They concluded that AMSA injection using the Wand system was very effective in anesthetizing lateral incisor, canine, and the first and second premolar. A previous study by Lee et al.[3], they compared anesthetic efficacy of the AMSA injection between using the CCLAD system and a conventional syringe. They concluded that the use CCLAD system was significantly more likely to result in pulpal anesthesia than the conventional syringe technique.

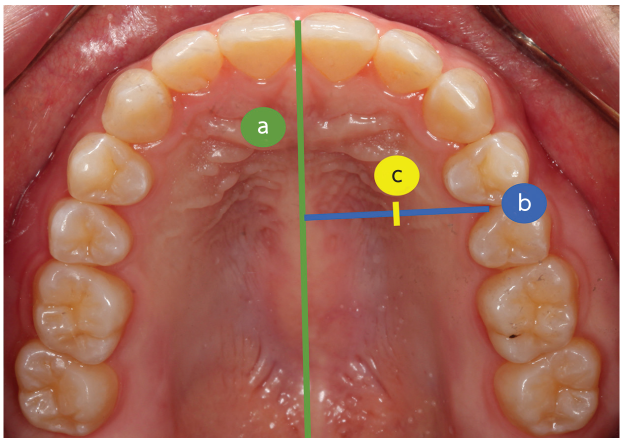
Most of the commercially available local anesthetic agents present in amide type. In 1948, lidocaine was introduced as the first commercialized amide local anesthetics and replaced the ester group as the drug of choice for local anesthetics in dentistry. Lidocaine is the gold standard agent, to which all new local anesthetic are compared.[4] Articaine differs from the other amide local anesthetics because it contains a thiophene ring instead of the benzene ring. The thiophene ring allows greater lipid solubility, which facilitates diffusion across the lipid-rich nerve membrane to access target receptors as the result they are well known and widely used in dental practice. Local anesthetic efficacy of articaine and lidocaine were compared when used for several injection techniques in many previous studies. Although some studies demonstrated that efficacy of articaine is better than lidocaine[5-9], and some study showed no difference between them.[10] No study compared their efficiency in AMSA injection technique especially used with conventional syringes. Therefore, the aim of this study was to compare the efficacy of articaine and lidocaine solution not only the anesthetic success but also the onset and duration when used to achieve profound anesthesia by AMSA injection technique using conventional syringe.

Materials and methods

Thirty three subjects who were the 1st- 6th year dental students of Rangsit University participated this study. Inclusion criteria were 1) the healthy young adult between age of 18 to 25 years, 2) the subjects who obtained informed consent, and 3) the subjects had vital all of the following teeth: the maxillary central incisor, maxillary lateral incisor, maxillary canine, maxillary first premolar and maxillary second premolar in the upper left quadrant and mandibular canine in the lower left quadrant. The exclusion criteria were allergies to local anesthetics or sulfites, pregnancy, breast feeding, active orthodontic treatment, fixed prostheses and extensive caries and/or filling. This study was approved by the Human Ethics Committee of Rangsit University.

The subject received 2 AMSA injections in 2 separate appointments. In the first appointment, the subject was administered one of the following two anesthetic solution groups: 4% articaine with 1 : 100,000 epinephrine (Septanest SP; Septodont) or 2% lidocaine with 1 : 100,000 epinephrine (Octocaine 100; Novocol) randomly. The volume of anesthetics used in this study was 0.9 ml. A cartridge of anesthetics contains 1.7 ml, the 0.8 ml of solution was removed by insulin syringe to obtain the 0.9 ml of the solution. The second injection was performed with the other anesthetic solution at the same side at least 2 weeks apart. The injection site was located on the hard palate at the midway along a line from the mid-palatal suture to the free gingival margin intersecting the contact point between the first and second premolars (Fig. 1).[11] After isolation with cotton rolls, the site was applied with topical anesthesia (Zap; Germiphene) for 60 seconds, then the local anesthetic agents was injected on the landmark using conventional syringe (Hu-Friedy) and 30-gauge, 21 mm needle (Terumo Dental needle). The needle bevel was located against the mucosa and was oriented at an angle of 45°. The needle was inserted very slowly into the tissue to establish contact with the palatal bone. The 0.9 ml of anesthetic solution was administered within two minutes.

The electric pulp tester (Digitest™; Parkell) was used to assess the pulpal response. The maxillary



รูปที่ 1 *ตำแหน่งที่ใช้ในการฉีดยาสกัดเส้นประสาทแอนทีเรียร์มิดเดิล ซูพีเรียร์อัลวีโอลาร์ a. คือเส้นที่ลากบริเวณแนวประสานกลางเพดาน b. เส้นที่ลากจากจุดสัมผัสระหว่างฟันกรามน้อยซี่ที่หนึ่งและสองไปยังแนวประสานกลางเพดาน c. จุดกึ่งกลางของเส้นที่ลากเชื่อมระหว่าง 2 ตำแหน่งดังกล่าว*

Fig. 1 *The landmark of the AMSA injection, a. is a line of the mid-palatal suture, b. is a line from contact point between the first and second premolar to the mid-palatal suture, c. is the intersecting point midway along them.*

central incisor, lateral incisor, canine, first premolar and second premolar in the same quadrant were assigned in the experimental teeth. The mandibular canine was assigned in the controlled tooth to ensure that the pulp tester was operating properly and the subject was responding appropriately. Toothpaste was used as a contacting medium and was applied on the probe tip, then the probe tip was placed midway between the gingival margin and the incisal/occlusal edge of the teeth. The maxillary second premolar, first premolar and canine were tested at the first minute after the injection. The maxillary lateral incisor, maxillary central incisor and mandibular canine were tested at the second minutes after injection. The measurement was repeated for two minutes interval.

As the criterion for pulpal anesthesia, a complete absence of response at the maximum output of the pulp tester (a reading of 64) was used. The anesthetic success was considered when obtaining two consecutive readings of 64 on the pulp tester. No anesthetic success within 10 minutes was considered as anesthetic failure. Time from the end of injection to the anesthetic success was defined as the onset. Then the pulpal response was reassessed for 5 minutes interval until tooth sensitivity returned. The length of time from anesthetic success achieved to tooth sensitivity returned was defined as duration.

Anesthetic success between anesthetic solutions was analyzed using the McNemar's test with the significance level at $p<0.05$. The t-test was used to compare the onset and duration of pulpal anesthesia between two anesthetic solutions at the 95% confidence level.

Results

Thirty-three young subjects, 20 (60.6%) women and 13 (39.4%) men with average age of 24 years (range = 21-25 years) participated in this study.

The anesthetic success rate was summarized in Table 1. The success rate of pulpal anesthesia of the AMSA injection ranged from 60.6 to 97.0% for articaine and from 24.2 to 63.6% for lidocaine. A comparison of anesthetic success between the two anesthetic solutions for each experimental tooth was analyzed. Our study showed that articaine provided more success in pulpal anesthesia than lidocaine for all teeth. There was statistically significant difference ($p<0.05$) of the success rate between of two anesthetic solutions.

The onset of pulpal anesthesia for articaine ranged from 3.45 ± 1.34 to 5.30 ± 1.87 minutes from the second premolar to the central incisor. For lidocaine, the onset ranged from 3.40 ± 1.39 to 6.75 ± 2.60 minutes. There was no statistically significant difference ($p>0.05$) in onset between the anesthetic solutions (Table 2).

ตารางที่ 1 เปรียบเทียบอัตราประสบความสำเร็จในการฉีดยาชาเทคนิคสกัดประสาทแอนทีเรียร์มิดเดิลซูพีเรียร์อัลวีโอลาร์ระหว่างการใช้อาร์ติเคนกับลิโดเคน

Table 1 The comparison of the anesthetic success rate between articaine and lidocaine when used for the AMSA injection.

Tooth	Anesthetic success rate		
	Articaine	Lidocaine	*p* value
Second premolar	93.9% (31/33)	60.6% (20/33)	0.001
First premolar	81.8% (27/33)	57.6% (19/33)	0.039
Canine	90.9% (30/33)	60.6% (20/33)	0.002
Lateral incisor	97.0% (32/33)	63.6% (21/33)	0.001
Central incisor	60.6% (20/33)	24.2% (8/33)	0.002

The duration of pulpal anesthesia for articaine ranged from 45.25 ± 30.07 to 61.00 ± 42.90 minutes from the second premolar to the central incisor. For the lidocaine, the duration ranged from 20.63 ± 16.35 to 41.25 ± 28.69 minutes. In most of the teeth, except the first premolars, there was statistically significant difference ($p<0.05$) in duration between the anesthetic solutions (Table 2).

Discussion

The AMSA injection is a relatively new technique that is not widely applied. This technique is considered to be an intraosseous technique as the majority of the anesthetic solution reaches the neurovascular bundle through the underlying bone instead of being dissipated into the surrounding soft tissues. The advantages of AMSA injection are reduced number of injection and low quantity of anesthetic solution administered in comparison with the conventional supraperiosteal infiltrative anesthesia applied in mul-

ตารางที่ 2 เปรียบเทียบการเริ่มต้นการชา และระยะเวลาการชาของการฉีดยาชาเทคนิคสกัดประสาทแอนทีเรียร์มิดเดิลซูพีเรียร์อัลวีโอลาร์ ระหว่างการใช้อาร์ติเคนกับลิโดเคน

Table 2 The comparison mean of onset and duration of pulpal anesthesia between articaine and lidocaine when used for the AMSA injection.

Tooth	Onset (minutes)			Duration (minutes)		
	Articaine	Lidocaine	*p* value	Articaine	Lidocaine	*p* value
Second premolar	3.45±1.34	3.90±1.77	0.083	58.55±35.24	41.25±28.69	0.031
First premolar	3.96±2.03	4.37±2.31	0.332	53.89±41.84	37.90±24.68	0.150
Canine	4.13±2.08	3.40±1.39	0.316	61.00±42.90	38.25±27.92	0.003
Lateral incisor	4.94±1.68	5.33±2.22	1.000	51.72±33.16	36.91±20.22	0.015
Central incisor	5.30±1.87	6.75±2.60	0.321	45.25±30.07	20.63±16.35	0.024

tiple injections for central incisor to second premolar teeth.[1]

The success of the local anesthesia depends on multiple factors including density and thickness of the bone in the area, access to the anatomy, length of the tooth roots to be anesthetized, type and dosage of the anesthetic agent, the patient's subjective pain threshold and response to painful stimuli.[1] In this study, the anesthetic agent success rate was highest in the lateral incisors, followed by second premolar, canine, first premolar and central incisor respectively. It would be the results of the position of apical foramen and number of root. The lateral incisor had the highest anesthetic success because of the deviations of the root apex and the apical foramen of the lateral incisor were displaced distolingually from the tooth axis.[12] The central incisor had the least anesthetic success because it had deviations of the root apex and the apical foramen was displaced distolabially from the tooth axis and far from injection side. The first premolar had less anesthetic success than the second premolar because of the higher incidence of two roots, which was 56.7%.[13] As a result, the buccal root of first premolar would be difficult to be reached when used for the AMSA injection. The recent study by Lee et al.[3] showed that the AMSA injections with computer-assisted and conventional syringe were very effective for pulpal anesthesia in the lateral incisor, canine and second premolar and less effective in central incisor and first premolar. That was similar to our study.

The present study found that articaine had higher anesthetic success rate than lidocaine (60.6-97.0% and 24.2-63.6% respectively) with statistically significant difference ($p<0.05$), which was a similar finding of the study by Srinivasan et al.[6] Their study compared the efficiency of 4% articaine with 1:100,000 epinephrine and 2% lidocaine with 1:100,000 epinephrine by using the maxillary buccal infiltration technique at maxillary first premolar and first molar area. They stated that articaine is able to diffuse through thick cortical bone and more reliable than lidocaine. It corresponded with our study that using articaine in AMSA injection through dense palatal bone was higher effective than lidocaine. This effect is related to high diffusion ability of articaine through bony and soft tissue. Articaine contains a thiophene ring that allows greater lipid solubility, which facilitates diffusion across the lipid-rich nerve membrane to access target receptors. That is the reason why articaine has more potency than lidocaine.[4]

The dissociation constant (pKa) affects the onset of local anesthesia. Lower pKa, means that more uncharged base molecules are present to diffuse through the nerve sheath; thus onset time is decreased. As the pKa of lidocaine and articaine are likewise (7.9 and 7.8 respectively), it is already anticipated that onset would occur at similar time for both anesthetics.[4] In our study, we did not find the statistically significant difference ($p > 0.05$) of onset between the two anesthetic solutions.

According to the degree of protein binding of local anesthesia is responsible for the duration of anesthetic activity. A greater protein binding produces longer duration. Articaine has protein binding of 95%, while lidocaine has only 65% protein binding rate.[4] In our study, the duration of anesthesia of articaine (45.25 ± 30.07 to 61.00 ± 42.90 minutes) was longer than those of lidocaine (20.63 ± 16.35 to 41.25 ± 28.69 minutes). There was statistically significant difference ($p < 0.05$) of duration between the two anesthetic solutions in each tooth, except the first premolars.

Nowadays, our society is steeping into ageing society, which is associated with higher incidence of systemic diseases. In dentistry, periodontal disease is a major problem in elderly. The periodontal surgery in the maxillary region requires the multiple injection of conventional technique. An advantage of the AMSA technique might be its feasibility in patients with cardiovascular compromised patients as less quantity of the anesthetic agents is administered in this technique. This technique can reduce the vasoconstrictor dose, reduce the number of injection, anxiety, stress and provide comfort for the patient. That is the reason why the AMSA injection technique may be important in the treatment. However, we can not confirm the clinical implication that the AMSA injection in elderly patients will be successful as well as our study group. Therefore, further study is needed to confirm that AMSA injection technique is still effective in the elder.

Conclusion

Within the limitations of the small sample size, we concluded that the AMSA injection with 4% articaine with 1:100,000 epinephrine had higher success rate and longer duration than those with 2% lidocaine with 1:100,000 epinephrine. Therefore, 4% articaine with 1:100,000 epinephrine had more efficacy than 2% lidocaine with 1:100,000 epinephrine.

Acknowledgments

The authors sincerely thank to Assistant Professor Dr.Tewarit Somkotra, Faculty of Dentistry, Chulalongkorn University for assistance in the statistical analysis. The authors report no conflicts of interest related to this study.

References

1. Friedman MJ, Hochman MN. The AMSA injection : a new concept for local anesthesia of maxillary teeth using a computer-controlled injection system. ***Quintessence Int*** 1998;29:297-303.
2. Fukayama H, Yoshikawa F, Kohase H, Umino M, Suzuki N. Efficacy of anterior and middle superior alveolar (AMSA) anesthesia using a new injection system : the Wand. ***Quintessence Int*** 2003;34:537-41.
3. Lee S, Reader A, Nusstein J, Beck M, Weaver J. Anesthetic efficacy of the anterior middle superior alveolar (AMSA) injection. ***Anesthesia Progress*** 2004;51:80-9.
4. Malamed SF. Handbook of Local Anesthesia. 5th ed. St. Louis : Elsevier Mosby, 2004.
5. Mikesell P, Nusstein J, Reader A, Beck M, Weaver J. A

comparison of articaine and lidocaine for inferior alveolar nerve blocks. ***J Endod*** 2005;31:265-70.

6. Srinivasan N, Kavitha M, Loganathan CS, Padmini G. Comparison of anesthetic efficacy of 4% articaine and 2% lidocaine for maxillary buccal infiltration in patients with irreversible pulpitis. ***Oral Surg Oral Med Oral Pathol Oral Radiol Endod*** 2009;107:133-6.
7. Batista da Silva C, Berto LA, Volpato MC, et al. Anesthetic efficacy of articaine and lidocaine for incisive/mental nerve block. ***J Endod*** 2010;36:438-41.
8. Brandt RG, Anderson PF, McDonald NJ, Sohn W, Peters MC. The pulpal anesthetic efficacy of articaine versus lidocaine in dentistry : a meta-analysis. ***J Am Dent Assoc*** 2011;142:493-504.
9. Rogers BS, Botero TM, McDonald NJ, Gardner RJ, Peters MC. Efficacy of articaine versus lidocaine as a supplemental buccal infiltration in mandibular molars with irreversible pulpitis : a prospective, randomized, double-blind study. ***J Endod*** 2014;40:753-8.
10. Vähätalo K, Antila H, Lehtinen R. Articaine and lidocaine for maxillary infiltration anesthesia. ***Anesth Prog*** 1993;40:114-6.
11. Velasco I, Soto R. Anterior and middle superior alveolar nerve block for anesthesia of maxillary teeth using conventional syringe. ***Dent Res J*** 2012;9:535-40.
12. Mizutani T, Ohno N, Nakamura H. Anatomical study of the root apex in the maxillary anterior teeth. ***J Endod*** 1992;18:344-7.
13. Chaparro AJ, Segura JJ, Guerrero E, Jimenez-Rubio A, Murillo C, Feito JJ. Number of roots and canals in maxillary first premolars : study of an Andalusian population. ***Endod Dent Traumatol*** 1999;15:65-7.