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Original Article

การเปรียบเทียบการชาและขอบเขตของการชาทางด้านเพดานปาก โดยการฉีดยาชาเฉพาะที่ด้านแก้มเพียงอย่างเดียวกับวิธีดั้งเดิมด้วยยาชาอาร์ติเคน 4 เปอร์เซ็นต์ผสมอิพิเนฟริน 1 : 100,000 ในการถอนฟันกรามบนซี่ที่สาม

Comparison of efficiency of palatal anesthesia and anesthetized areas between single buccal infiltration and conventional technique with 4% articaine with epinephrine 1 : 100,000 for maxillary third molar extraction

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บทคัดย่อ

บทนำ : การถอนฟันบนโดยทั่วไปจะใช้เทคนิคการฉีดยาชาเฉพาะที่ด้วยวิธีดั้งเดิมซึ่งต้องฉีดยาชาทั้งทางด้านแก้มและด้านเพดานปาก แต่ด้วยลักษณะทางกายภาพของเนื้อเยื่อด้านเพดานปากที่มีความหนาแน่นสูง การฉีดยาชาบริเวณนี้จึงทำให้เกิดความเจ็บปวดอย่างมากสำหรับผู้ป่วย จากหลายการศึกษา พบว่าการฉีดยาชาเฉพาะที่ด้านแก้มเพียงอย่างเดียวสามารถทำให้เนื้อเยื่อด้านเพดานปากชาเพียงพอต่อการถอนฟันบนได้เนื่องจากลักษณะทางกายภาพของกระดูกที่มีรูพรุนและบาง ทำให้ยาชาอาร์ติเคนซึ่งเป็นยาชาที่มีความสามารถในการแทรกซึมสูงสามารถแพร่ผ่านไปยังเพดานปากและทำให้เนื้อเยื่อทางเพดานปากชาได้ การศึกษานี้มีวัตถุประสงค์เพื่อประเมินว่าการฉีดยาชาเฉพาะที่ด้านแก้มเพียงอย่างเดียวด้วยยาชาอาร์ติเคน 4 เปอร์เซ็นต์ผสมอิพิเนฟริน 1 : 100,000 จะสามารถทำให้ผู้ป่วยรู้สึกชาด้านเพดานปากเพียงพอสำหรับการถอนฟันกรามบนซี่ที่สามโดยไม่ต้องฉีดยาชาด้านเพดานปากได้หรือไม่และเพื่อหา

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ขอบเขตของการชาด้านเพดานปากจากการฉีดยาชาเฉพาะที่ด้านแก้มเพียงอย่างเดียว

วิธีดำเนินการ : ทำการศึกษาในผู้ป่วยจำนวน 24 ราย ที่ได้รับการถอนฟันกรามบนซี่ที่สามทั้ง 2 ข้าง สำหรับข้างที่เป็นกลุ่มควบคุมจะถูกฉีดยาชาเฉพาะที่ด้วยวิธีดั้งเดิม กล่าวคือ ด้านแก้มใช้ยาชา 1.1 มล. และด้านเพดานปากใช้ยาชา 0.6 มล. สำหรับข้างที่เป็นกลุ่มทดลองจะถูกฉีดยาชาเฉพาะที่ด้านแก้มเพียงอย่างเดียวโดยใช้ยาชา 1.7 มล. แล้วประเมินความเจ็บปวดด้วยค่าวีอาร์เอส และหาขอบเขตการชา จากนั้นจึงถอนฟันกรามบนซี่ที่สามและประเมินความเจ็บปวดด้วยค่าวีเอเอส

ผลการวิจัย : ใช้การทดสอบไคสแควร์คำนวณทางสถิติของการชาของเนื้อเยื่ออ่อนก่อนการถอนฟัน ค่าที่ได้แสดงถึงความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ ($p<0.05$) ส่วนการใช้การทดสอบทีชนิดจับคู่คำนวณทางสถิติของขอบเขตการชา (ด้านหน้า) ทั้งที่ขอบเหงือกและที่ระดับ 5 มม. เหนือขอบเหงือก พบว่ามีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ ($p<0.05$) แต่ค่าขอบเขตของการชา (ด้านหลัง) ที่ระดับ 5 มม. เหนือขอบเหงือกและค่าวีเอเอสหลังจากถอนฟัน พบว่าไม่มีความแตกต่างกันอย่างมีนัยสำคัญ ($p>0.05$) จากการทดสอบทีชนิดจับคู่ และไคสแควร์ ตามลำดับ

สรุปและอภิปรายผล : 1) ร้อยละ 75.0 ของกลุ่มทดลองสามารถถอนฟันกรามบนแท้ซี่ที่สามได้โดยการฉีดยาชาเฉพาะที่ด้านแก้มเพียงอย่างเดียวด้วยยาชาอาร์ติเคน 4 เปอร์เซ็นต์ผสมอิพิเนฟริน 1 : 100,000 จำนวน 1 หลอด และรอยาชาออกฤทธิ์ 10 นาที 2) ขอบเขตการชา (ด้านหน้า) ทางด้านเพดานปากของการฉีดยาชาเฉพาะที่ด้านแก้มเพียงอย่างเดียวแคบกว่าวิธีดั้งเดิม โดยมีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ 3) ขอบเขตการชา (ด้านหลัง) ที่ระดับ 5 มม.เหนือขอบเหงือก และค่าวีเอเอสหลังถอนฟันของการฉีดยาชาเฉพาะที่ด้านแก้มเพียงอย่างเดียวไม่มีความแตกต่างอย่างมีนัยสำคัญกับวิธีดั้งเดิม

คำสำคัญ : อาร์ติเคน การฉีดยาชาเฉพาะที่ด้านแก้มเพียงอย่างเดียว ฟันกรามบนซี่ที่สาม

Abstract

Introduction : normally, for simple maxillary tooth extraction, we have to perform 2 sides of local anesthesia injection, but the anatomical structure of human hard palate is covered by a dense tissue, which can become painful when performing the palatal injection. Many studies proved that single buccal infiltration could provide adequate soft tissue anesthesia for maxillary third molar extraction because of thin and porous bone, especially with articaine which has greater lipid solubility and can diffuse through palate. The objectives of this study were to determine if single buccal infiltration with 4% articaine with epinephrine 1 : 100,000 alone could provide adequate palatal anesthesia for maxillary third molar extraction and to evaluate its extension on the palatal aspect.

Materials and methods : there were 24 patients enrolled in this study for bilateral maxillary third molar extraction. In control side, conventional technique of injection with 1.7 ml of 4% articaine with epinephrine 1 : 100,000 (1.1 ml at buccal side and 0.6 ml at palatal side) was performed. In experimental side, single buccal infiltration with 1.7 ml of 4% articaine with epinephrine 1:100,000 was performed. After injection, all patients were required to use the Verbal Response Scale

(VRS) while doing soft tissue anesthesia assessment by an assigned researcher (anesthetized area of the marginal gingiva, anesthetized area of the attached gingiva 5 mm above the cervical margin) followed by extraction then completed with Visual Analogue Scale (VAS) score.

Results : **the chi-square test showed statistically significant difference for soft tissue anesthesia assessment before extraction (p <0.05). The paired t-tests for anesthetized area (anteriorly) of both marginal gingiva and attached gingiva 5 mm above the cervical margin showed statistically significant differences (p <0.05). But the paired t-test for anesthetized area (posteriorly) of attached gingiva 5 mm above the cervical margin and the chi-square test for VAS scores after extraction both showed no statistically significant difference (p >0.05).**

Conclusions : **1) 75.0% of the experimental group had successful maxillary third molar extractions by the single buccal infiltration technique using one cartridge of 4% articaine with epinephrine 1 : 100,000 and onset time up to 10 minutes. 2) The palatal anesthetized area (anteriorly) in single buccal infiltration technique had less coverage than in conventional technique (statistically significant difference). 3) The palatal anesthetized area (posteriorly) of attached gingiva 5 mm above the cervical margin and VAS score after extraction both showed no statistically significant difference between single buccal infiltration technique and conventional technique.**

Keywords : **articaine, oral surgery, palatal injection, single buccal infiltration**

Introduction

Articaine is the widely used amide local anesthetic agent which has thiophene ring and an additional ester ring that increases the lipid solubility and affects the ability of diffusion through soft tissue and bone.[1-3] Furthermore, articaine is a safe local anesthetic agent due to its rapid rate of metabolism into an inactive metabolite.[4-6]

Palatal injection is considered a painful injection due to tight attachment of palatal mucosa to underlying bone, a dense vascularization and innervation.[7,8] And for many patients, palatal injection was proved to be a traumatic experience even though adjunctive anesthesia, topical anesthesia application, topical cooling of palate, computerized injection systems, pressure administration, eutectic mixture of local anesthesia (EMLA), transcutanous electronic nerve stimulation (TENS) were applied.[9] In addition, many studies claimed that single buccal injection is sufficient to provide palatal anesthesia for extraction of maxillary posterior teeth.[7,9-13] The reason for single buccal injection providing palatal anesthesia, firstly, anatomy of buccal maxilla bone is porous and thin, thus any local anesthetic agents, especially articaine, can diffuse through bone. Secondly, extraction required anesthetic volume less than routine conservative dental treatment.[7]

The objectives of this clinical study were to determine if single buccal infiltration anesthesia with 4% articaine with epinephrine 1:100,000 alone can provide

palatal anesthesia for maxillary third molar extraction without palatal injection and to evaluate its extension on the palatal aspect.

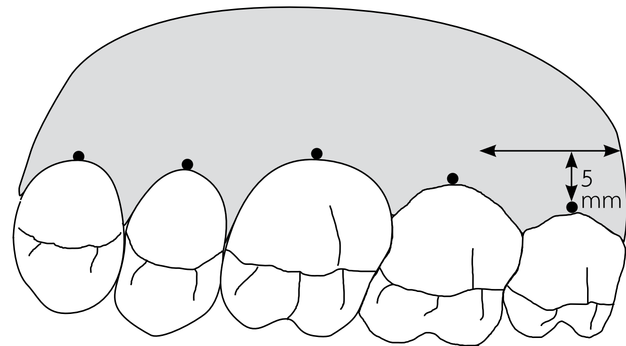
Materials and methods

The project number for Certificate of Approval by Ethical Committee of Research Institute of Rangsit university is RSEC 11/2557. The procedures were performed in the Surgery Clinic of the Faculty of Dental Medicine, Rangsit University. Twenty-four patients were included to participate in the study, after obtaining written informed consent. Panoramic radiograph was taken. Each patient was randomly assigned to one of the following two injection techniques by lotting : 1) conventional local anesthesia technique (buccal infiltration + palatal injection) or 2) single buccal infiltration without palatal injection.

Before the administration of the local anesthetic agent, each patient was informed about the Verbal Response Scale (VRS) and the Visual Analogue Scale (VAS) by the assigned researcher. The VRS consisted of one question : Is the stabbing pain or no pain? The VAS was composed of an un-marked, continuous, horizontal, 100-mm line, anchoraged by the end points of “no pain” on the left and “worst pain” on the right.

Same local anesthetic agent (4% articaine with epinephrine 1:100,000) was used for both groups. The randomly chosen technique was applied for the first extraction, while the other technique was applied for the second extraction. All the injections were performed by the same surgeon.

In conventional technique; buccal infiltration was injected with 1.1 ml of local anesthetic agent at height of mucobuccal fold above the apex of tooth. Palatal injection was injected using 0.6 ml of local anesthetic agent at keratinized tissue 10 mm medial



รูปที่ 1 *การประเมินการชาของเนื้อเยื่ออ่อน แนววัดแรกอยู่ที่ขอบเหงือกด้านเพดาน ส่วนแนววัดที่ 2 อยู่ในแนวเส้นสมมติเหนือขอบเหงือก 5 มม.*

Fig. 1 *Soft tissue anesthesia assessment. The first measurement was done along the marginal gingiva of palatal side, whereas the second measurement was done along the imaginary line 5 mm above the cervical margin.*

from the gingival margin. The soft tissue anesthesia assessment was performed at 10 minutes[8] after the injection.

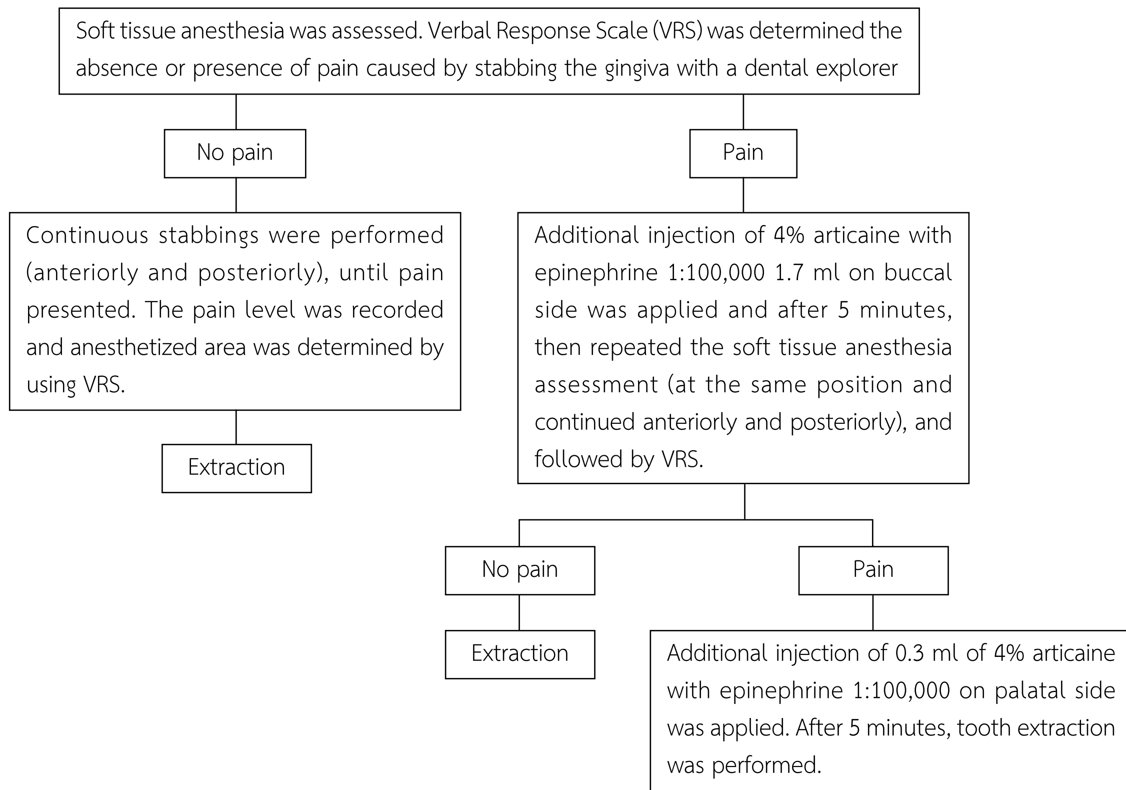
In the experimental side; buccal infiltration was injected totally with 1.7 ml of local anesthetic agent at height of mucobuccal fold above the apex of tooth. The soft tissue anesthesia assessment was performed 10 minutes[8] after the injection.

Soft tissue anesthesia assessment

The locations for soft tissue assessment were divided into 2 areas. The first area was determined by stabbing along the marginal gingiva, whereas the second area was determined by stabbing along the imaginary line 5 mm above the cervical margin as showed in Fig. 1. The soft tissue anesthesia assessment protocol followed by the procedure were described in Fig. 2.

Pain after extraction

Following completion of the extraction, patients



รูปที่ 2 *ผังแสดงการประเมินการชาของเนื้อเยื่ออ่อน และกระบวนการถอนฟัน*

Fig. 2 *Flow chart of soft tissue anesthesia assessment and extraction procedures.*

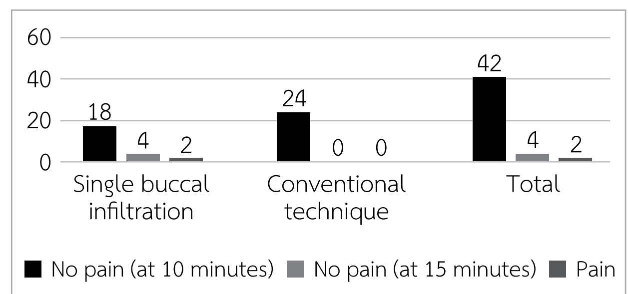
acted as their own controls to complete the Visual Analogue Scale (VAS).

Data analysis

The hypothesis was determined using chi-square and paired t-test. Chi-square was used for comparing between pain and no pain of soft tissue anesthesia assessment or VRS before extraction and also VAS score after extraction. Paired t-test was used for comparing anesthetized area (anteriorly) of marginal gingiva and attached gingiva 5 mm above the cervical margin and anesthetized area (posteriorly) of attached gingival 5 mm above the cervical margin at palatal aspect as millimeters between two groups.

Result

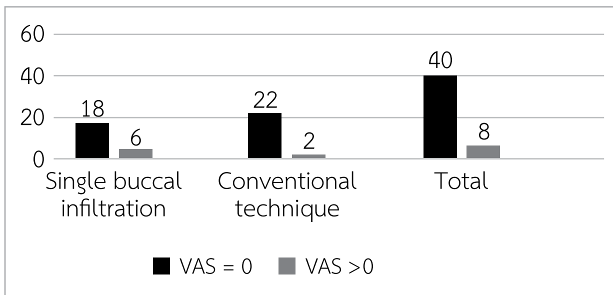
Twenty-four patients were enrolled in this study, which 11 were males and 13 were females. Age was ranging from 20 to 52 years old and the mean age was 25.1 years old.



รูปที่ 3 *เปรียบเทียบอาการปวดและไม่ปวดระหว่างผู้ป่วย 2 กลุ่ม*

Fig. 3 *Comparison of pain or no pain between 2 groups.*

Among of the conventional technique group 100% (24 patients) of patients had no pain when performing soft tissue anesthesia assessment at 10 minutes after injection. While the single buccal infiltration group, 75.0% (18 patients) of patients had no pain when performing soft tissue anesthesia assessment at 10 minutes after injection, 16.7% (4 patients) of patients had no pain when performing soft tissue



รูปที่ 4 *เปรียบเทียบคะแนนวีเอเอสภายหลังการถอนฟันระหว่าง 2 กลุ่ม*

Fig. 4 *Comparison of VAS score after extraction between 2 groups.*

anesthesia assessment at 15 minutes after injection and only 8.3% (2 patients) of patients still had pain when performing soft tissue anesthesia assessment at 15 minutes after injection. (Fig. 3)

The chi-square test showed statistically significant difference for soft tissue anesthesia assessment before extraction ($p < 0.05$).

The mean of anesthetized area (anteriorly) at marginal gingiva of conventional technique group was 8.77±3.87 mm, whereas the mean of single buccal infiltration group was 5.55±2.89 mm. The paired t-test showed statistically significant difference ($p < 0.05$) between the means of 2 groups.

All (24 patients) of conventional technique group had anesthetized area at marginal gingiva on distal aspect of the maxillary third molar, whereas only 87.5% (21 patients) of single buccal infiltration group had anesthetized area at marginal gingiva on distal aspect of the maxillary third molar.

The mean of anesthetized area (anteriorly) of the attached gingiva 5 mm. above the cervical margin in conventional technique group was 24.23±11.78 mm, whereas the mean of single buccal infiltration group was 11.68±8.75 mm. The paired t-test showed statistically significant difference ($p < 0.05$) between the means of 2 groups.

The mean of anesthetized area (posteriorly) of the attached gingiva 5 mm. above the cervical margin in conventional technique group was 3.00±1.02 mm, whereas the mean of single buccal infiltration group was 3.55±2.39 mm. The paired t-test showed no statistically significant difference ($p > 0.05$) between the means of 2 groups.

VAS score after extraction

In the single buccal infiltration group, 75.0% (18 patients) had VAS score = 0, and 25.0% (6 patients) had VAS score > 0 (the mean of VAS score was 20.0).

Meanwhile, in the conventional technique group, VAS score = 0 was 91.7% (22 patients), and 8.3% (2 patients) had VAS score > 0 (the mean of VAS score was 17.5). The chi-square test showed no statistically significant difference for VAS score after extraction ($p > 0.05$) (Fig. 4).

Discussion

Pain is an unpleasant sensory and emotional experience associated with tissue damage. Therefore, many methods to decrease or eliminate pain were introduced including local anesthetic agent. The concept of local anesthetic action is based on blocking the generation and conduction of nerve impulses.

Due to the substitution of the aromatic ring with a thiophene ring, and the presence of an additional ester ring, provides articaine with increased liposolubility and intrinsic potency, as well as greater plasma protein binding versus other commonly used local anesthetic agents. These differential characteristics are in turn clinically reflected by a shorter latency and increased duration of anesthesia, as well as superior bony tissue diffusion.

Palatal injection has been considered as a discomfort and painful injection technique due to the tight attachment of palatal mucosa to underlying

bone. The adjunctive techniques were used for reduction of the pain when the palatal injection was performed, such as topical anesthesia application, topical cooling of palate, etc. but the efficiency of those technique was not enough to eliminate all the discomfort feeling, so the single buccal infiltration technique was introduced to replace the conventional technique that normally used for maxillary third molar extraction.

Success or failure of anesthesia may relate to many factors. In susceptible individuals, dental treatment may cause elevation in state of anxiety, which in turn may influence the experience of pain and discomfort.[14]

Not only psychological factor, but bone density and anatomical factor may also contribute to the success/failure. Most of the successful single buccal infiltration for maxillary third molar extraction cases were young and female patients. From the study by Al-Nakib to determine local bone mineral density (BMD) with cortical thickness. The bone density measured in Hounsfield unites by the aid of CT scan according to gender and age, as a mean, males show higher density than females.[15] That meant the density affected the diffusion of the local anesthetic agent. And most of the successful cases had quite small and convergent roots.

4 patients (16.7%) had to have more local anesthetic agent with single buccal infiltration technique and wait for five more minutes before successful extraction. Thus, the different personalities and pain threshold, it may cause the patient perceived the pain differently. While in the process of the research, 2 out of 4 cases admitted about their worries and fear of dental extraction. However, we still could not conclude why these 4 cases needed one more additional cartridge of single buccal infiltration even they had small and convergent roots.

Only 2 patients (8.3%) in the study had pain when stabbing the explorer into gingival sulcus after waiting for 10 and 15 minutes then had to perform palatal injection at last. We observed that all of these cases had large, divergent multiple roots with thick cortical bone and wide tuberosities. These may relate to failure of single buccal infiltration even in young ages.

Although, the anesthetized area at palatal aspect in experimental group was lesser than in control group, it was adequate to perform the single maxillary third molar extraction without any palatal injection needed. And also, according to the VAS score, the depth of anesthesia in experimental group showed no statistically significant difference between both techniques.

The result of our study was similar to those of Fan et al, comparing the efficiencies of permanent maxillary tooth removal performed with single buccal infiltration versus routine buccal and palatal injection using 4% articaine/HCl. All patients completed a 100-mm VAS and there was no statistically significant difference between 2 sides.[7]

Moreover, the study by Sina et al, comparing single buccal infiltration and conventional technique (buccal and a palatal injection) using 4% articaine/HCl with 1:100 000 epinephrine. All patients completed a Faces Pain Scale (FPS) and a 100-mm VAS after extraction. The VAS and FPS scores were compared and the difference was not statistically significant.[9]

Conclusion

1. 18 out of 24 cases (75.0%) had a successful maxillary third molar extraction by the single buccal infiltration technique using one cartridge of 4% articaine with epinephrine 1:100,000 and onset time up

to 10 minutes with no pain.

2. 6 out of 24 cases (25.0%) needed an additional buccal infiltration. Then 4 cases (16.7%) had a successful maxillary third molar extraction at 15 minutes, while the other 2 cases (8.3%) needed another additional palatal injection, followed by extraction at 15 minutes.

3. The palatal anesthetized area (anteriorly) in the single buccal infiltration technique had less coverage than in conventional technique (statistically significant difference).

4. The palatal anesthetized area (posteriorly) at the attached gingiva 5 mm. above the cervical margin of the maxillary third molar and VAS score after extraction of single buccal infiltration technique had no statistically significant difference to the conventional technique.

Suggestion

To achieve the successful outcome of painless maxillary third molar extraction, from our study we suggested that the single buccal infiltration technique can provide sufficient anesthetic effect on the extraction site without any additional painful palatal injection. After all, we have to make a good case selection by using both radiographic and physical examination. The radiographic examination is very useful to evaluate the amount and configuration of the roots, whereas the physical examination is important to determine other surrounding anatomical structures, such as tuberosity and exostosis. Those may affect the diffusion of the local anesthetic agents. However, VAS score showed no statistically significant difference, only with notification of longer onset time of the local anesthetic agent.

เอกสารอ้างอิง

1. Malamed SF. Handbook of local anesthesia. 5th ed. St. Louis : Mosby, 2004:73-7.
2. McLure H, Rubin A. Review of local anaesthetic agents. ***Minerva Anesthesiol*** 2005;71:59-74.
3. Snoeck M. Articaine : a review of its use for local and regional anesthesia. ***Local Regional Anesthesia*** 2012;5:23-33.
4. Katyal V. The efficacy and safety of articaine versus lignocaine in dental treatments : a meta-analysis. ***J Dent*** 2010;38:307-17.
5. Thakare A, Bhate K, Kathariya R. Comparison of 4% articaine and 0.5% bupivacaine anesthetic efficacy in orthodontic extractions : prospective, randomized crossover study. ***Acta Anaesthesiol Taiwan*** 2014;52:59-63.
6. Vree TB, Gielen MJ. Clinical pharmacology and the use of articaine for local and regional anaesthesia. ***Best Pract Res Clin Anaesthesiol*** 2005;19:293-308.
7. Fan S, Chen WL, Yang ZH, Huang ZQ. Comparison of the efficiencies of permanent maxillary tooth removal performed with single buccal infiltration versus routine buccal and palatal injection. ***Oral Surg Oral Med Oral Pathol Oral Radiol Endod*** 2009;107:359-63.
8. Lima-Junior JL, Dias-Ribeiro E, de Araujo TN, et al. Evaluation of the buccal vestibule-palatal diffusion of 4% articaine hydrochloride in impacted maxillary third molar extractions. ***Med Oral Patol Oral Cir Bucal*** 2009;14: E129-32.
9. Sina U, Dayangac E, Araz K, et al. Is permanent maxillary tooth removal without palatal injection possible? ***Oral Surg Oral Med Oral Pathol Oral Radiol Endod*** 2006;102: 733-5.
10. Costa C, Tortamano I, Rocha R, Francischone C, Tortamano N. Onset and duration periods of articaine and lidocaine on maxillary infiltration. ***J Prosthet Dent*** 2005;36:197-201.
11. Isik K, Kalayci A, Durmus E. Comparison of depth of anesthesia in different parts of maxilla when only buccal

anesthesia was done for maxillary teeth extraction. ***Int J Dent*** 2011;2011:575874.

12. Kandasamy S, Elangovan R, John RR, Kumar CN. Removal of maxillary teeth with buccal 4% Articaine without using palatal anesthesia—A comparative double blind study. ***J Oral Maxillofac Surg Med Pathol*** 2015;27:154-8.
13. Somuri A, Rai A, Pillai M. Extraction of permanent maxillary teeth by only buccal infiltration of articaine. ***J Maxillofac Oral Surg*** 2013;12:130-2.
14. Rainville P. Pain and emotions. In : Price DD, Bushnell MC, eds. Progress in pain research and management : psychological methods of pain control, basic science and clinical perspectives. Seattle : IASP Press, 2004:117-41.
15. Al-Nakib L. Computed tomography bone density in Hounsfield units at dental implant receiving sites in different regions of the jaw bone. ***J Bagh College Dent*** 2014; 26:92-7.