

Efficacy of anterior and middle superior alveolar (AMSA) anesthesia using a new injection system: The Wand

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Objective: This study examined the effect of anterior and middle superior alveolar (AMSA) field block of maxillary nerves using a new local anesthetic system—the Wand. **Method and materials:** Twenty healthy volunteers aged 23 to 44 years were used in the study. Either side of the maxillary teeth was randomly selected for AMSA injection; the other side was left as a control. For each side, 1.8 mL of 2% lidocaine solution with 1/80,000 epinephrine was injected by the Wand on a point that bisects the maxillary first and second premolars and is midway between the crest of the free gingival margin and the midpalatine suture. Pain rating score (PRS) and visual analogue scale (VAS) were applied for measurement of puncture, insertion, and injection pain. Electric pulp stimulation was given to each maxillary tooth every 10 minutes for 1 hour after the injection in order to find out the specific tooth on which AMSA injection was effective. **Results:** During needle insertion, 14 out of 20 subjects answered moderate pain and VAS showed 27.3 mm (mean). During injection, 11 of 20 revealed no pain and the mean of VAS was 14.5 mm. No one claimed severe pain by PRS. Electric pulp stimulation indicated that lateral incisors, canines, and first and second premolars were more anesthetized than central incisors and first molars. **Conclusion:** AMSA injection using the Wand method seems to avoid severe injection pain and seems to be very effective for pulpal anesthesia at lateral incisors, canines, and premolars. (*Quintessence Int* 2003;34:537–541)

Key words: AMSA, local anesthesia, pain rating score, pulp tester, VAS, Wand

CLINICAL RELEVANCE: Precise evaluations of pain and pulpal anesthesia indicates that a field block of anterior and middle superior alveolar (AMSA) branches of the maxillary nerve is very effective for pulpal anesthesia at lateral incisors, canines, and premolars. Also, AMSA injections caused less pain even on the palate.

Injection of local anesthetic is commonly used in general dental practice. The injection, however, gives fear and pain to the patients more than generally expected.¹⁻³ Also, many practitioners feel stress during injection using the large muscles of the shoulder and arm with an awkward position of the thumb. A new injection system, without discomfort for both of them, has long been awaited in dentistry.⁴

Recently, a new injection system, the Wand (Milestone Scientific) was developed in the United States and was widely accepted internationally.^{5,6} It is composed of a driving unit, a foot controller, and a handpiece connected to a needle. It provides a method for infiltration and conduction anesthesia commonly used. In addition, it enables field blocks by palatal approach to anterior superior alveolar (P-ASA)⁷ and anterior and middle superior alveolar (AMSA) branches of the maxillary nerve and can be performed without pain.^{8,9}

Although AMSA injection has been clinically proven to be very effective for anesthesia on the maxillary teeth, precise examinations of pain sensation at injection, and degree of pulpal anesthesia have not been clarified. The purpose of the present study was to examine the effect of AMSA injections using this new anesthesia system.

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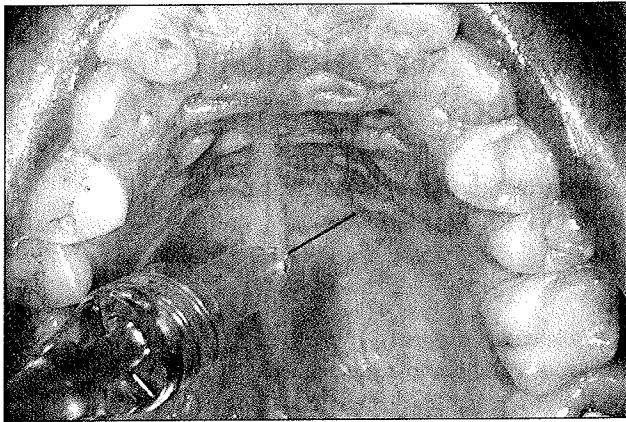


Fig 1 Injection site. Anterior and middle superior alveolar (AMSA) branches of the maxillary nerve were injected.

METHOD AND MATERIALS

Twenty healthy volunteers, from the ages of 23 to 44 years (27.3 ± 5.4 [mean \pm standard deviation]) were used in the study. Informed consent was obtained from each volunteer. The subjects were not on any medications and had no history of nerve injury or pathosis or allergic reaction to local anesthetics. Twelve teeth on both sides from central incisor to first molar were examined for vitality using radiograph oral inspection and electric pulp testing. Teeth restored by full-covered crowns were excluded in this study. Either side of the maxilla was anesthetized by AMSA injection using 1.8 mL of 2% lidocaine solution with 1/80,000 epinephrine (Xylocaine Cartridge for Dental Use, Fukisawa). The needle used was 32 gauge \times 0.5 in, 0.26×12 mm (Misawa Medical). The injection was accurately performed according to the manual of the Wand (Milestone Scientific).¹⁰ The injection site was a point that bisected the maxillary first and second premolars and was midway between the crest of the free gingival margin and the midpalatine suture. The needle was oriented at a 45-degree angle to the mucous membrane with the bevel facing the palatal tissue (Fig 1). Immediately after the bevel contacted the mucosa, a slow rate of injection was commenced and the needle was slowly penetrated into the palate. When contacting the bone, the needle was kept in the same place and the rest of the anesthetic was administered. The flow rate of the anesthetic solution was kept slow, which needed approximately 4 minutes to be administered. After completion of deposition, the needle was left in the same place for 10 seconds to release the pressure within the handpiece.

Immediately following the injection, the subjects responded to both pain rating score (PRS) and visual analogue scale (VAS) in order to assess the intensity of subjective pain. Pain rating score is composed of four levels of pain; no pain, slight pain, moderate pain, and severe pain. A subject chose the level equivalent to the degree of pain felt. Visual analogue scale is a 100-mm long segment of a horizontal line, the far left end indicating no pain and the far right indicating intolerable pain. A volunteer checked the point he/she felt appropriate. The distance between the left end and the point checked was determined as the degree of pain.

After the PRS and VAS measurements, the effect of AMSA of each tooth was evaluated using electric pulp stimulation every 10 minutes up to 60 minutes (7 times). An electric pulp tester (Analytic Technology) was applied to 12 maxillary teeth, from the first molar to the central incisor on both sides. After the tooth was dried with gauze, dentifrice was applied to the probe tip, which was placed on the labial or buccal plane of the tooth. The current rate was set at four, and the reading of initial sensation was recorded. Thirty seconds were needed to increase from no output (0 reading) to the maximum output (80 reading). Statistical analysis of the two groups was performed by paired *t* test. Differences were considered significant at $P < .01$.

RESULTS

There was no subject who showed an allergic reaction or any other complication due to AMSA injections. No one complained of collateral anesthesia to the face and lips.

During needle insertion (puncture), 3 of 20 subjects reported no pain, 14 reported slight pain, 3 reported moderate pain, and no subjects reported severe pain. When injecting local anesthetic, 11 subjects answered no pain, 6 slight pain, and 3 moderate pain, respectively. Also, no one reported severe pain during injection. Pain recordings at VAS (mean \pm SD) were 27.3 ± 22.7 mm at the time of puncture and 14.5 ± 18.6 mm at the time of injection, respectively.

Figure 2 shows pulpal anesthesia of the examined teeth throughout 60 minutes. All groups of teeth were anesthetized by AMSA injections up to 40 minutes. Lateral incisors, canines, and first and second premolars showed higher percentages of maximal 80 readings compared to central incisors and first molars. The difference was statistically significant.

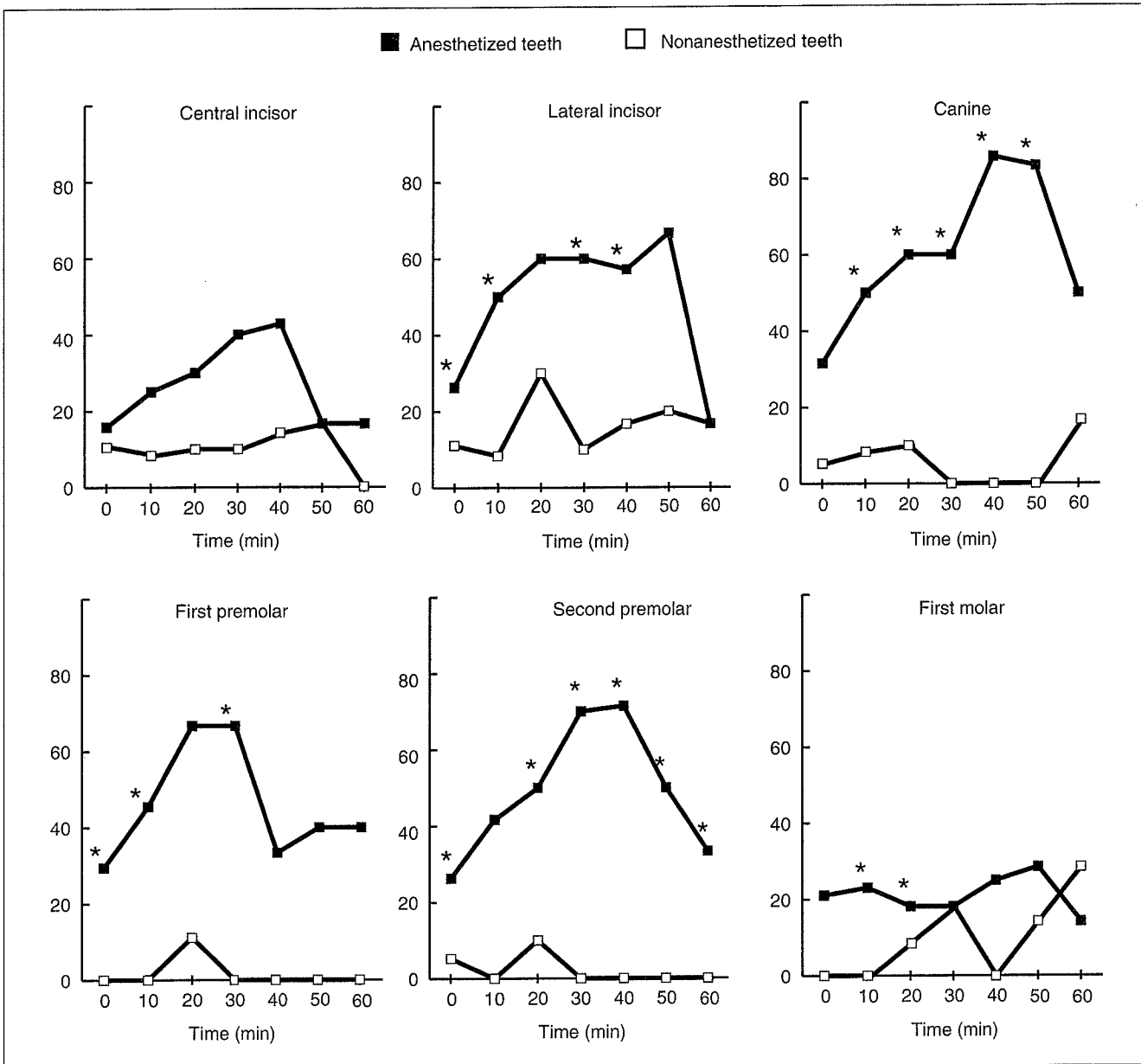


Fig 2 Incidence of pulpal anesthesia in the examined maxillary teeth after injection and the percentage of 80 pulp tester readings. * = significant difference ($P < .01$) between control teeth and anesthetized teeth.

DISCUSSION

Many dental patients tend to avoid treatment because of fear of local anesthesia by needle injection. It is thought to be one of the most painful procedures among the dental practices.¹ In order to reduce the pain, some dentists like to use topical anesthetic before injection,¹¹ some try to puncture the mucosa very softly, and some administer local anesthetic very slowly. However, not all of these actions and efforts have been successful enough to eliminate the puncture and injection pain completely.

It is well known that slow injection of local anesthetic is less painful than rapid injection, especially for anesthesia in dentistry. It is, however, very difficult because a palm-thumb grasp needs greater power to inject the anesthetic and adjusts the pressure according to the tissue density. It is almost impossible to give the anesthetic at a constant slow flow rate with precise handling using a conventional syringe.⁵

The Wand had been developed in the US and is already commercially available. Two modes, rapid and slow speeds of injection, are regulated by the foot controller. A central processor unit (CPU) in the driving

unit continuously monitors the pressure of injection and keeps constant flow rate regardless of the varying resistance of the tissue. The manual¹⁰ recommends not only conventional modes of local anesthesia, such as infiltration or conduction, but also AMSA branch block of maxillary nerve^{3,8} and PASA nerve block.⁷ The unique handpiece allows for an ultralight penlike grip, which enables delicate and precise handling of the needle.

The current authors used bidirectional rotation insertion technique according to the manual.¹⁰ Hochman and Friedman¹² reported the accuracy of the rotation insertion technique by the Wand.

The Wand has been introduced for dental anesthesia, but its unique characteristics also are utilized in other fields. For example, Tan et al¹³ used the Wand for anal anesthesia and patients reported excellent efficiency.

Although infra-alveolar nerve (IAN) block is commonly used for multiple-tooth anesthesia of the mandible, efficient maxillary block, especially of premolar teeth, has not been utilized. Anterior and middle superior alveolar injection has the advantage that one injection anesthetizes multiple teeth but no collateral anesthesia occurs in the mucobuccal fold. As a result, the smile line is not distorted. No collateral anesthesia of the facial tissues including the upper lip by AMSA injections occurred during not only the present study but also clinical application. Injection of palatal tissue can be very painful unless soft and precise puncture and constant slow flow rate are secured. The Wand has enabled the practitioner to give injection at the palate comfortably and painlessly. However, anterior and middle superior alveolar injection requires some training for the practitioner, and the authors believe it was clinician error that caused one unsuccessful case in the current study. This was due to selection of the wrong injection site; it was more posterior than aimed, since a 45-degree injection needs a more anterior initial puncture point.

Pain rating score (PRS) and visual analogue scale (VAS) are commonly used for subjective assessment of pain. Although VAS is thought to be a *de fact* standard for pain assessment, the data sometimes differ individually like in the current results. On the other hand, pain rating score is simple enough for the patients to understand.

A reading of 80 on the scale is the maximum electrical currency of this pulp tester. It is well understood that complete anesthesia at the tooth is performed if no sensation is felt at 80. However, it is also said that a reading of less than 80 often indicates sufficient achievement of pulpal anesthesia. Although the current results suggest that lateral incisors, canines, and first and second premolars are better anesthetized by AMSA injections than central incisors and first mo-

lars, the latter were also well anesthetized in clinical practice.

There are some reports on using electric pulp testers.⁴⁻¹⁶ The researchers studied pulpal anesthesia by the intraosseous injection system and new anesthetics. The current authors believe that the tester is a good device to measure efficacy of local anesthesia of human subjects.

Even though the Wand system is so pleasant that many patients like to choose the system, it still has a needle that scares the patient. "Needle-less" local anesthesia has long been discussed and some clinical devices have been introduced. However, they have not replaced the conventional needles and syringe systems. Further developments and studies are required to replace these conventional syringes.

CONCLUSION

The present examination reveals AMSA injection using a new anesthetic system, the Wand, which prevents severe puncture and injection pain and is very effective in anesthetizing lateral incisors, canines, and first and second premolars in the maxilla with one injection. The new system provides comfortable anesthesia for patients and can be a good alternative for conventional manual syringe injection.

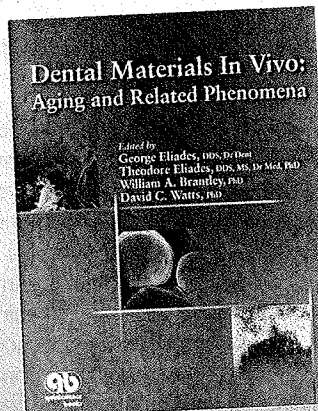
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