Case Report

Dentistry Section

AMSA (Anterior Middle Superior Alveolar) Injection: A Boon To Maxillary Periodontal Surgery

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ABSTRACT

Introduction: Local anesthetics have been in use in dental practice for more than 100 years. The advent of local anesthetics with the development of nerve blockade injection techniques heralded a new era of patient comfort while permitting more extensive and invasive dental procedures.

Discussion: Today's availability of a variety of local anesthetic agents enables dentists to select an anesthetic that possesses specific properties such as time of onset and duration, hemostatic control and degree of cardiac side effects that are appropriate for each individual patient and for each specific dental procedure. The ease of the technique is its advantage and disadvantage should always be considered before its acceptance.

Conclusion: The importance of this review was to bring about awareness among the general clinician who have to use multiple injection for any treatment to be performed in the maxillary arch. The non compliance of the treatment on the maxillary arch is usually due to these factors. Hence introducing this technique can help patient compliance as well ease for the clinician. Also the duration of treatment is reduced.

Key Words: Articaine, Flap surgery, Anterior middle superior

INTRODUCTION

Maxillary mucogingival or flap surgery usually requires up to five injections to obtain anesthesia of the hard and soft tissues. Posterior superior alveolar, middle superior alveolar, and anterior superior alveolar block injections are used to anesthetize buccal tissues whereas greater palatine and nasopalatine blocks are used for palatal anesthesia. Although this series of injections effectively anesthetizes maxillary tissues, it may also inadvertently affect facial structures such as the upper lip, lateral aspect of the nose, and lower eyelid [1,2].

The palatal soft tissue anesthesia is achieved without numbness to the lips and face or interference with the muscles of facial expression. A bilateral AMSA injection supposedly anesthetizes 10 maxillary teeth extending from the second premolar on one side to the second premolar on the opposite side [3].

The AMSA injection derives its name from the injection's ability to supposedly anesthetize both the anterior and middle superior alveolar nerves [4].

The middle superior alveolar (MSA) and anterior superior alveolar (ASA) nerves branch from the infraorbital nerve before they exit from the infraorbital foramen. The middle superior alveolar nerve is thought to innervate the maxillary premolars and plays some role in pulpal innervation of the mesiobuccal root of the first molar. The anterior superior alveolar nerve provides pulpal innervation to the central and lateral incisors and canines [5]. The plexus where both nerves join is the target site for the AMSA injection [6].

ARTICAINE

Articaine is an analogue of prilocaine in which the benzene ring moiety found in all other amide local anesthetics has been replaced with a thiophene ring. To date, only one formulation has been approved in the United States, a 4% solution with **1:100,000** epinephrine. With a higher per-cartridge unit cost and a pulpal anesthesia duration of approximately one hour with soft-tissue anesthesia for two to four hours, it would initially appear that articaine is a less attractive agent for dental applications. However, with a slightly faster onset of action (1.4 to 3.6 minutes), reports of a longer and perhaps more profound level of anesthesia and most notably frequent practitioner anecdotes of a greater ability to diffuse through tissues, articaine has become a very widely used anesthetic agent in developed countries. The tissue diffusion characteristics of articaine are not well-understood. However, in a variable percentage of patients, a maxillary infiltration injection in the buccal vestibule will result in adequate palatal anesthesia for tooth extraction.

THE MAXILLA

Most problems with maxillary anesthesia can be attributed to individual variances of normal anatomical nerve pathways through the maxillary bone [7]. While the pulpal sensory fibers of the maxillary teeth are primarily carried in the anterior, middle and posterior superior alveolar nerves which also supply the buccal soft tissues, accessory pulpal innervation fibers may be found in the palatal innervations supplied by the nasopalatine and greater palatine nerves [7]. By careful application of topical anesthetics, distraction techniques (application of pressure and/or vibration) and slow delivery of the anesthetic agent, palatal injections can be given with very little to no patient discomfort. With the availability of articaine hydrochloride 4% with epinephrine many practitioners are finding that palatal injections may not be necessary when it is injected into the maxillary buccal vestibule [8]. Additionally, new computer-controlled anesthetic delivery systems are particularly aimed at eliminating or at least minimizing, the discomfort of palatal injections [9,10,11].

ANESTHETIZE PATIENT (DIFFICULTIES)

Many factors may affect the success of local anesthesia, some within the practitioner's control and some clearly not. While no

single technique will be successful for every patient, guidelines exist that can help reduce the incidence of failure. A failure will be defined as inadequate depth and/or duration of anesthesia to begin or to continue a dental procedure. Due to a number of factors, such as thicker cortical plates a denser trabecular pattern larger, more myelin(lipid)-rich nerve bundles and more variable innervation pathways [12-19], more problems of inadequate anesthesia occur in the mandibular arch than in the maxillary. Although failures are more common in the mandibular arch, maxillary failures do occur and can be equally frustrating. Another concern is the situation where anesthesia of all apparent nerve pathways is achieved but the duration is short and/or the depth of anesthesia is poor. Giving a second injection into the same site as the first injection may prove adequate simply due to the increased volume of anesthetic solution. However, using a different anesthetic agent for the second injection may increase the likelihood of successful duration. This difference may be explained by individual variances in tissue pH conditions and differing characteristics of each anesthetic agent such as dissociation characteristics, lipid solubilities and receptor site protein-binding affinities. No contraindication exists for using any of the amide anesthetic agents in combination with one another. However, care must be taken to limit the total dosage of anesthetic given to the maximum amount allowable for the agent with the lowest permissible dosage.

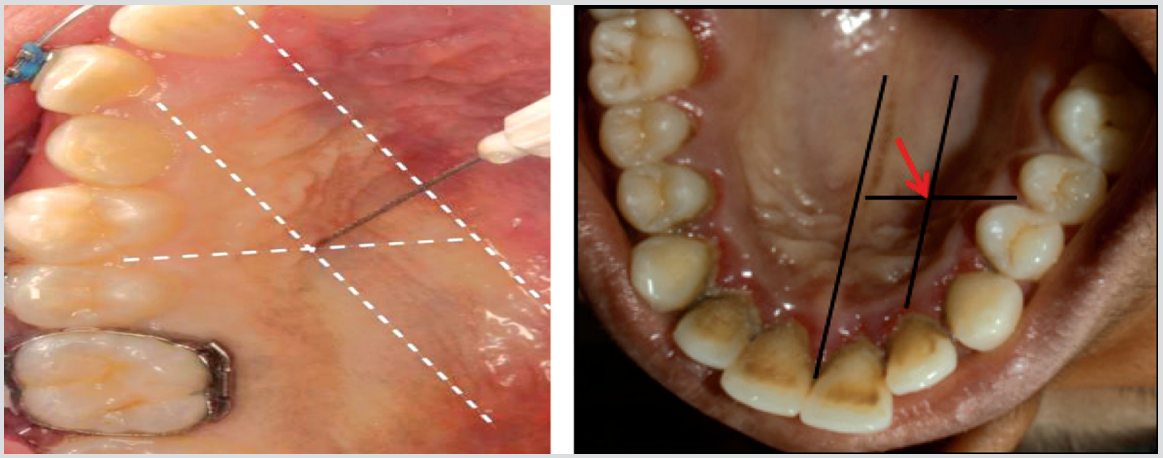
TECHNIQUE FOR ANESTHESIA

Malamed described the injection site to be on the hard palate about halfway along an imaginary line connecting the mid-palatal suture to the free gingival margin as shown in [Table/Fig-3&4]. Another description of the injection site is that it is located on the hard palate [Table/Fig-1] at the intersection of a vertical line bisecting the premolars and a horizontal line halfway between the mid-palatine raphe and the crest of the free gingival margin [20].

To avoid patient discomfort due to the tightly bound nature of the palatal tissue, the anesthetic agent should be injected into the site at a methodic rate of 0.5 ml per minute [3]. Slow deposition of the anesthetic agent, the bound nature of the palatal tissue promotes diffusion of the anesthetic agent through the palatal bone via numerous nutrient canals [3]. A successful AMSA injection typically blanches the palatal tissue in a unilateral fashion that does not cross the midline [21]. Anesthesia of structures typically innervated by the greater palatine nerve, nasopalatine nerve, anterior superior alveolar nerve and middle superior alveolar nerve is achieved [22,23,24]. A conventional syringe with a 27-gauge needle was used to deliver one carpule of 4% articaine with 1:100,000 epinephrine to the right palate via the AMSA injection over 4 minutes [25]. Depositing a sufficient volume of the local anesthetic allows it to diffuse through the nutrient canals [Table/Fig-1] and porous cortical bone to envelope the concentrated subneural dental plexus at this location [1]. It is also speculated that due to resiliency of palatal tissue, the anesthetic solution reaches the underlying bone and neuro-vasculature anatomy [7]. It is the bound quality of the palatal tissue which promotes the diffusion of the anesthetic agent through the palatal bone via numerous nutrient canals (Table/Fig-1] [23].

[Table/Fig-1]: Palatal nutrient canals

[Table/Fig-2]: Anesthetic range of AMSA injection



[Table/Fig-3 & 4]: To locate the nutrient canals (*J Periodontol* 2008;79)

ADVANTAGE [25]

The ability of the AMSA injection to cover large maxillary surgical fields provides multiple benefits because it reduces the cumulative number of necessary injections [Table/Fig-2].

The elimination of repetitive transmucosal punctures, the elimination of multiple injections reduces the total amount of delivered vasoconstrictor and may prove useful for cardiovascular-compromised patients requiring maxillary anesthesia.

For maxillary anterior esthetic procedures, the AMSA's maintenance of upper lip function allows for continuous evaluation of gingival contours unimpeded by the "lip drooping" that typically occurs with traditional anesthetic techniques.

Maxillary mucogingival procedures, the AMSA's palatal delivery of a full carpule of anesthetic with vasoconstrictor provides outstanding hemostasis and reduces the need for multiple re-injections to attain hemostatic control during graft harvest.

The AMSA injection anesthetizes the buccal tissues from the palatal aspect, no vasoconstrictor affects the buccal gingiva and outstanding blood supply is maintained for nourishment of the connective tissue graft.

DISADVANTAGES [25]

- The use of a computer-assisted injection system is recommended as the best method for administering AMSA injections. The added cost of this anesthetic delivery system is one potential drawback of the AMSA injection.
- The long administration time: Some patients may find it disconcerting to have an injection last 4 minutes, and attempts to speed up the AMSA injection may lead to increased patient discomfort at the injection site.
- The reduction of cumulative anesthetic vasoconstrictor may also prove to be problematic for certain surgical procedures.
- The reduction in vasoconstrictor proves beneficial forcardiovascular-compromised patients, it may lead to less than desirable hemostatic control.
- The AMSA eliminates the need for multiple injections, less vasoconstrictor enters the buccal tissues and a subsequent decline in hemostasis may obscure portions of the surgical field.
- Several cases of short-lived anesthesia in the maxillary central incisor region is usually noted.

DISCUSSION

Multiple injection technique used for maxillary arch treatment is usually stressful hence the single block for treatment purpose has offered greater advantage and treatment acceptance. The benefit of palatal AMSA injection is that it reduces the number of injections and also the amount of anesthetic solution compared to conventional buccal infiltration anesthesia that applies multiple injections to each tooth. In addition, more teeth can be anesthetized with a single injection without numbness of lips and face [29]. The majority of literature on the computer-controlled injection system (the Wand) has dealt with the pain of injection with the computer-assisted injection system compared to injection using a conventional syringe [26]. In general, the results have been favourable for the computer-assisted injection system with only 2 studies showing no difference [27] and 1 study showing higher pain ratings10. Another study using the VRS (verbal rating scale) compared computer-controlled and conventional local anesthesia delivery systems for performing scaling and root planing on patients with moderate periodontal disease; AMSA injections with the Wand were considered less painful than the conventional syringe [28]. Computer-controlled anesthesia using the Wand appears advantageous for restorative procedures because more teeth are anesthetized with one palatal injection and without numbness of lips and face, in contrast to multiple conventional buccal anesthetic injections for each tooth. The AMSA injection is a novel anesthetic technique that may prove useful for certain maxillary periodontal surgeries [30].

CONCLUSION

The importance of this review was to bring about awareness among the general clinician who have to use multiple injection for any treatment to be performed in the maxillary arch. The non compliance of the treatment on the maxillary arch is usually due to these factors. Hence introducing this technique can help patient compliance as well ease for the clinician also the duration of treatment is reduced.

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