İCMAL • REVIEW

Anatomical Basis of the Anterior Middle Superior Alveolar Nerves (AMSA)

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The Anterior Middle Superior Alveolar (AMSA) injection is a maxillary anesthetic technique designed to provide pulpal anesthesia to multiple maxillary teeth through a single palatal injection. This review examines the anatomical basis of the technique—the trigeminal nerve and its maxillary division, the superior alveolar branches, the superior dental plexus, and palatal innervation—and summarizes the clinical development and application of the AMSA block.

Keywords: *AMSA injection, maxillary anesthesia, superior alveolar nerves, superior dental plexus, palatal innervation*

11. Introduction

The Anterior Middle Superior Alveolar (AMSA) nerve block was introduced in 1998 by Mark J. Friedman and Mark N. Hochman as part of the development of computer-controlled local anesthetic delivery systems in dentistry. The technique emerged during their work on a computer-assisted anesthesia device later commercialized as The Wand [1].

The AMSA injection is a maxillary anesthetic technique designed to provide pulpal anesthesia to multiple maxillary teeth through a single palatal injection. Unlike conventional supraperiosteal infiltrations, the AMSA technique relies on the anatomical relationships among the superior alveolar nerves, the superior dental plexus, and the porous nature of the palatal and maxillary bone [2]. A comprehensive understanding of AMSA anesthesia requires knowledge of the trigeminal nerve, particularly the maxillary division (V2), and its superior alveolar branches: the anterior superior alveolar (ASA), middle superior alveolar (MSA), and posterior superior alveolar (PSA) nerves.

12. The Trigeminal Nerve (Cranial Nerve V)

The trigeminal nerve is the fifth cranial nerve and the principal sensory nerve of the face and oral cavity. It divides into three branches: V1, V2, and V3. The maxillary division (V2) is the branch relevant to AMSA anesthesia because it supplies the maxillary teeth, palate, and surrounding structures [3].

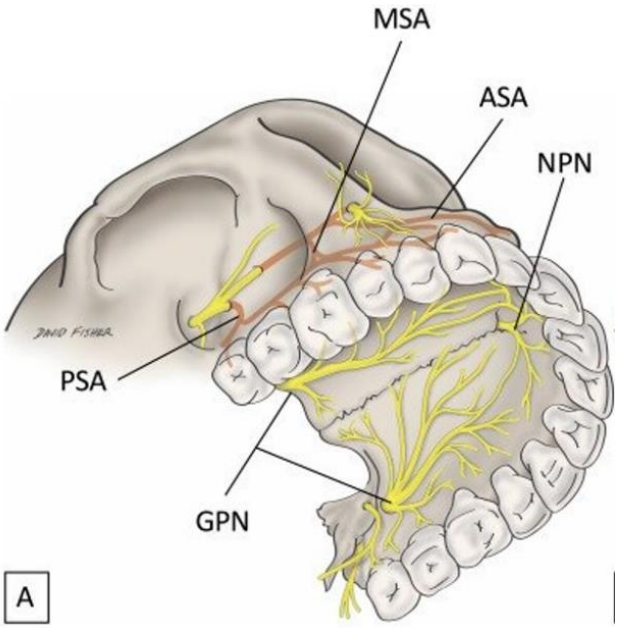


Figure 1. The maxillary division (V2) of the trigeminal nerve and its superior alveolar branches (ASA, MSA, PSA) forming the superior dental plexus.

12.1 The Maxillary Nerve (V2)

The maxillary nerve exits the skull through the foramen rotundum and enters the pterygopalatine fossa, where it gives rise to the posterior superior alveolar (PSA) nerve before continuing anteriorly as the infraorbital nerve. Within the infraorbital canal, the infraorbital nerve gives off the middle superior alveolar (MSA) nerve and the anterior superior alveolar (ASA) nerve [4]. These branches form the superior dental plexus supplying the maxillary dentition [2].

12.2 Middle Superior Alveolar Nerve (MSA)

The MSA nerve is anatomically variable and may be absent in a considerable percentage of individuals. When present, it originates from the infraorbital nerve within the infraorbital canal and descends within the lateral wall of the maxillary sinus toward the premolar region. The MSA commonly innervates the maxillary premolars, the mesiobuccal root of the first molar, associated buccal periodontal tissues, and adjacent sinus mucosa. When absent, its territory is usually supplied by overlapping fibers from the ASA and PSA nerves [2,3].

12.3 Anterior Superior Alveolar Nerve (ASA)

The ASA nerve arises from the infraorbital nerve near the anterior portion of the infraorbital canal and descends inferomedially through a bony canal in the anterior wall of the maxillary sinus. It provides sensory innervation to the maxillary incisors, canines, supporting periodontal structures, associated labial gingiva, and portions of the nasal cavity. Because of its extensive contribution to the superior dental plexus, the ASA nerve plays a central role in AMSA anesthesia [3,4].

13. The Superior Dental Plexus

The superior dental plexus is a network of neural communications formed by the superior alveolar nerves (ASA + MSA + PSA). It is located superior to the apices of the maxillary teeth within the cancellous bone of the maxilla. Through extensive neural overlap, the plexus allows communication among the ASA, MSA, and PSA branches. Clinically, this overlap explains why anesthetic solution deposited at one site may diffuse sufficiently to anesthetize several adjacent teeth. The superior dental plexus constitutes the principal anatomical target of the AMSA injection technique [2].

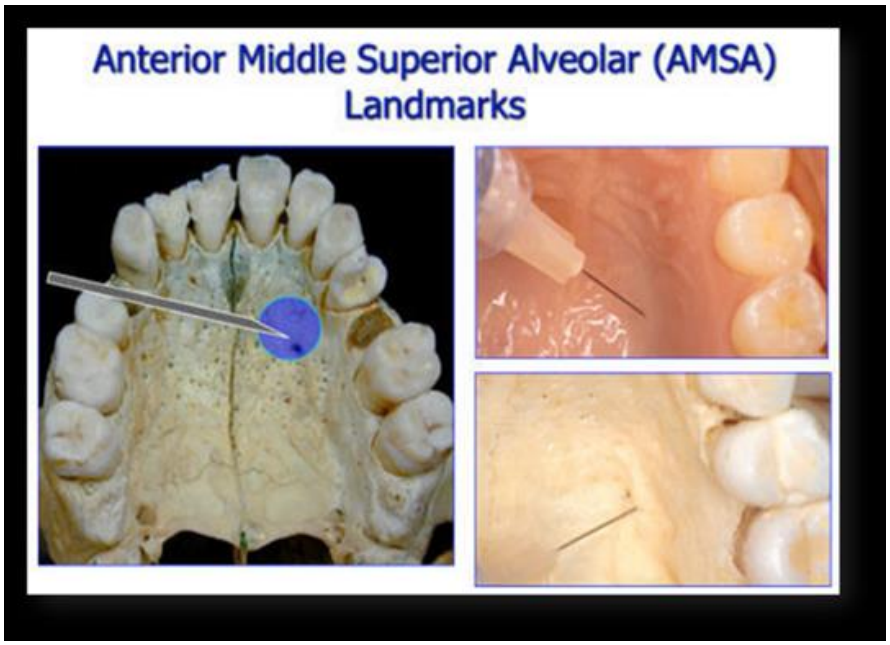


Figure 2. Anterior Middle Superior Alveolar (AMSA) landmarks and the neural overlap of the superior dental plexus within the cancellous bone of the maxilla.

14. Palatal Innervation Relevant to AMSA

The hard palate is primarily supplied by the greater palatine nerve posteriorly and the nasopalatine nerve anteriorly [4]. The greater palatine nerve emerges through the greater palatine foramen and courses anteriorly within the palatal mucosa and submucosa [3]. The AMSA injection site is generally located midway between the midpalatine raphe and the free gingival margin in the premolar region. At this location, the palatal bone contains nutrient canals and relatively porous cancellous bone that facilitate anesthetic diffusion toward the superior dental plexus [2].

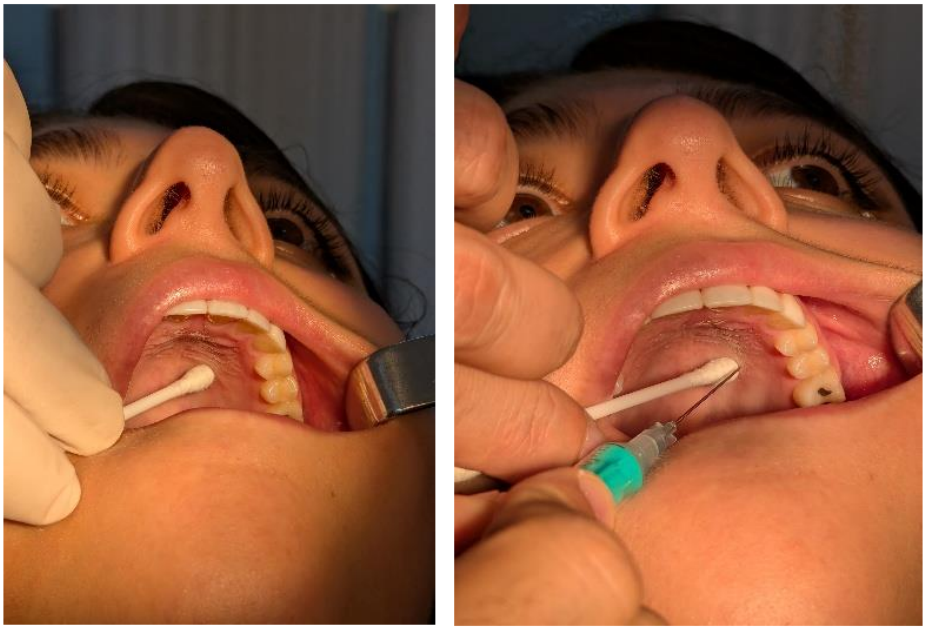


Figure 3. Palatal AMSA injection site — located midway between the midpalatine raphe and the free gingival margin in the premolar region — and its clinical application.

15. Materials and Methods

Friedman and Hochman sought to develop a technique capable of anesthetizing multiple maxillary teeth with a single injection while minimizing facial soft tissue anesthesia. Their investigations coincided with advances in computer-controlled local anesthetic delivery technology, which enabled anesthetic solution to be deposited at a very slow and constant rate. This represented a major departure from conventional syringe injections, especially in palatal tissues, where rapid administration had traditionally been associated with significant pain [1,5].

Through clinical experimentation, they observed that anesthetic deposited into the palatal tissues could diffuse through nutrient canals and porous palatal bone to reach the subneural dental plexus supplying the maxillary teeth [1,6]. The injection site was standardized at a point on the hard palate located approximately midway between the midpalatal suture and the free gingival margin, typically between the maxillary first and second premolars. From this location, anesthetic could diffuse to affect branches of both the ASA and MSA nerves, providing pulpal anesthesia to the maxillary incisors, canines, and premolars, along with associated palatal soft tissues [2,7].

16. Anatomical Basis of the AMSA Injection

The AMSA injection was developed to provide pulpal anesthesia to multiple maxillary teeth through a single palatal injection while minimizing collateral soft tissue anesthesia of the lips and facial muscles [1,8]. The technique relies on diffusion of local anesthetic through the porous palatal bone and nutrient canals into the cancellous bone surrounding the superior dental plexus [2,3,4]. Anesthetic solution is deposited slowly in the palatal mucosa between the maxillary premolars; from this point, it diffuses superiorly and laterally toward the subneural dental plexuses associated with the ASA and MSA nerves (AMSA = ASA + MSA) [2,5]. As a result, the AMSA injection may anesthetize maxillary incisors, canines, premolars, and occasionally the mesiobuccal root of the first molar [1,2]. The degree of anesthesia achieved depends on individual anatomical variations, especially the presence or absence of the MSA nerve and differences in maxillary bone density [2,4,6].

17. Discussion

Initially, the AMSA injection generated considerable discussion within the dental community. Some clinicians reported variable success rates and inconsistent pulpal anesthesia, partly because of anatomical variations in the presence and distribution of the MSA nerve. Some authors debated whether the AMSA should be classified as a true nerve block or as a field block based on anesthetic diffusion through the maxillary dental plexus. Despite these discussions, the technique gradually gained acceptance and became recognized as an important advancement in minimally traumatic and patient-centered dental anesthesia [2,5,6].

18. Results

The AMSA nerve block represented a significant innovation in dental local anesthesia because it introduced the concept of achieving multi-tooth maxillary anesthesia from a single palatal injection while avoiding extensive numbness of the lips and facial musculature. The preservation of facial muscle function was particularly advantageous in cosmetic dentistry, periodontal therapy, and restorative procedures requiring continuous evaluation of the patient's smile and facial esthetics. The technique was formally described in the late 1990s in association with the introduction of computer-controlled anesthetic delivery systems; subsequent developments also led to the description of related palatal injection techniques, including the Palatal Anterior Superior Alveolar (P-ASA) nerve block [1,8].

19. Conclusion

The anterior middle superior alveolar (AMSA) anesthesia technique represents a relatively novel approach to maxillary local anesthesia with encouraging preliminary clinical outcomes. Available evidence suggests that it may offer several advantages over conventional anesthetic techniques in appropriately selected cases, particularly with respect to anesthetic efficacy and patient comfort. Nevertheless, the current literature is limited, and further well-designed randomized controlled trials, larger sample sizes, and long-term clinical evaluations are required to validate its efficacy, safety, and reproducibility. Additionally, increased clinical experience and operator training will be essential for optimizing its application.

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