# Maxillary nerve block—A new approach using a computer-controlled anesthetic delivery system for maxillary sinus elevation procedure. A prospective study

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**Objective:** The maxillary (or second division) nerve block is an effective method of achieving profound anesthesia of a hemimaxilla. This block can be used for procedures involving the maxillary sinus, including the maxillary sinus elevation procedure. The purpose of this study was to evaluate a computer-controlled anesthetic delivery system (Wand) for maxillary nerve block injection to attain maxillary sinus anesthesia for sinus floor elevation procedure. **Method and materials:** The study population consisted of 61 healthy adult patients, ranging in age from 40 to 72 years (mean 45 years), who received 76 maxillary nerve blocks (17 having both right and left maxillary blocks) by means of the Wand system via the greater palatine nerve approach, for sinus floor elevation procedure. Two patients (3%) were excluded from the study due to the inability to negotiate the greater palatine foramen. For each block, two cartridges of 2% lidocaine hydrochloride with adrenaline (1:100,000) were administered, using a 27-gauge–long needle. After ensuring the anesthetized areas (waiting time 2.5 minutes), the sinus elevation procedure was performed. Parameters recorded were the success or failure of anesthesia, positive (blood) aspiration, bony obstructions in the greater palatine canal, and complications. **Results:** The use of this technique increased the ability to more easily locate the greater palatine foramen. A local infiltration (at the incisor region) was needed in 13 (17%) of the blocks, and seven (9.2%) sites required an extra infraorbital block injection in addition to the maxillary nerve block. One block had a positive aspiration. There were no bony obstructions demonstrated in the canal interfering with the injection, and no complications were recorded. **Conclusion:** The Wand appears to offer a number of advantages over the hand-held syringe when the greater palatine block technique for the maxillary nerve block is used. It is suggested that, when indicated, and with the required knowledge and respect for the associated anatomy, this technique should be considered with greater ease and more confidence. *(Quintessence Int 2004;35:477–480)*

**Key words:** computer-controlled anesthetic delivery system, hemimaxilla, maxillary nerve block

The maxillary nerve block (MNB) is an effective method of achieving profound anesthesia of a hemimaxilla. It is useful in procedures involving quadrant dentistry or in extensive maxillary surgical procedures. One of two approaches is available to gain access to the terminal point for anesthetic delivery–the greater palatine canal (GPC) and the high tuberosity approach (HT). The major difficulty encountered with use of the respective techniques is locating the canal for the GPC technique and the higher incidence of hematoma for the HT.[1] Few studies on the MNB have been published in recent literature. The technique is seldom used for dental procedures in the office, and when used, it is conducted with extreme caution. Before attempting this block, the operator should develop sufficient confidence and cooperation from the patient. A sudden movement from the patient due to painful stimulus could compromise the safety of the technique or lead to unwanted complications.[2]

The ability to better predict and easily anesthetize the maxillary nerve and its branches with a single injection could make it possible to perform surgical procedures, such as maxillary sinus elevation for dental implants in the posterior maxilla, as routine procedures in the private clinic.

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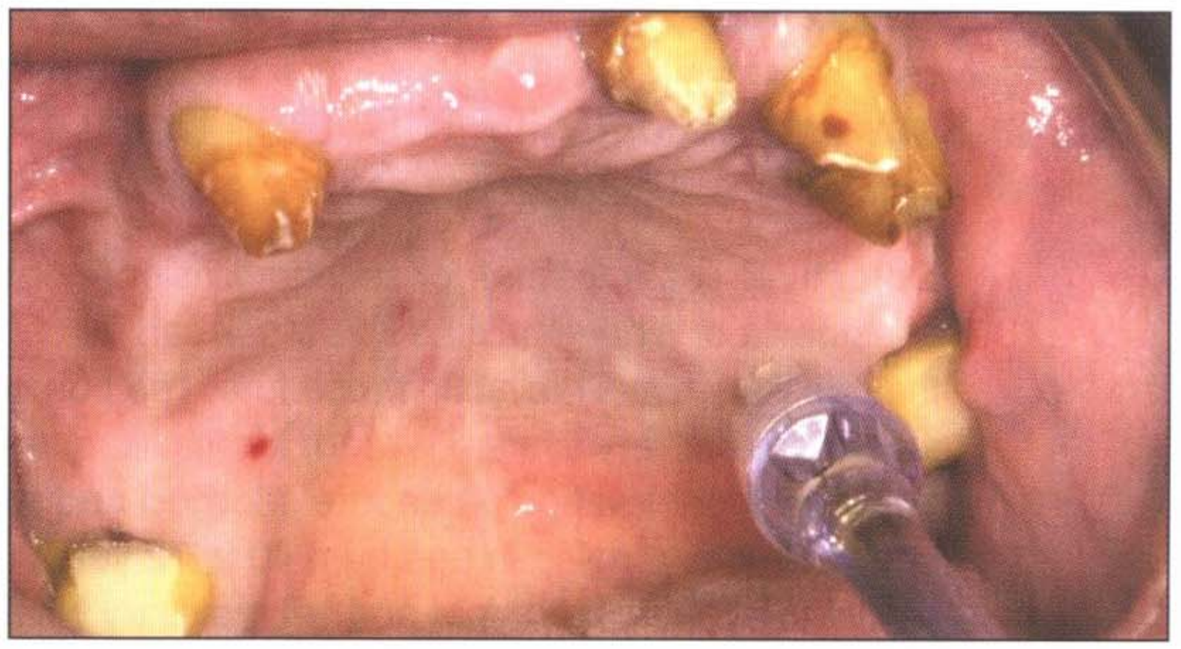
**Fig 1** *(left)* Greater palatine foramen: A palatal view of a dry skull.

**Fig 2** *(below)* Palatal view of the maxillary nerve block through the greater palatine foramen approach using the computer-assisted anesthetic delivery system. Note the blood spot on the contralateral side immediately after injection.



The use of a computer-controlled anesthetic delivery system for maxillary sinus elevation procedure via the GPC approach is described.

## PARTICIPANTS AND METHODS

The study was conducted in a private clinic using a computer-controlled device (Wand, Milestone Scientific) by a senior oral and maxillofacial surgeon. Since October 1999, 61 adult healthy patients, ranging in age from 40 to 72 years (mean 45 years) received 76 maxillary nerve blocks (17 had both right and left maxillary blocks) by means of the Wand, a computer-controlled anesthetic delivery system, via the GPC approach. Two patients (3%) were excluded from the study due to an inability to negotiate the greater palatine foramen. Indication for using regional maxillary nerve anesthesia was to perform sinus floor elevation procedures (on one or both sides).

A detailed technique for maxillary block injection via the greater palatine foramen has been previously described.[1] Briefly, the palatal soft tissue, directly over the greater palatine foramen (GPF), is the area of insertion. A landmark for the GPF is the junction of the maxillary alveolar process and palatine bone (Fig 1). The needle is oriented toward the palatal soft tissues (Fig 2). Immediately prior to the bevel contacting the soft tissue, the foot switch is activated to the slow flow-rate position to ensure a positive flow of anesthetic at the moment the needle penetrates the tissue. During needle insertion (approximately three fourths of its length), continuous, controlled, positive pressure delivers an anesthetic drip that precedes the needle, creating an anesthetic pathway without the use of a topical anesthetic. Auto-aspiration (simple removal of the foot from the foot pedal) set at 12 seconds was performed immediately after ensuring that the needle was located in the GPC at the terminal needle position.

After injecting the first cartridge (1.8 mL), a second cartridge was inserted into the machine without removing the needle from its position in the GPC. The device should be located at head level or beneath to ensure that air does not penetrate into the delivery system. Lidocaine hydrochloride (HCl) (2%) with epinephrine (1:100,000) as a vasoconstrictor (Lidocadren 2%, TEVA Pharmaceutical) was administered for each block using a total injection volume of 2.1 cartridges (range 2 to 5). A 27-gauge, 1 ¼-inch–long (30 mm) needle was used (Becton Dickinson).

Successful anesthesia was considered to be present when the entire hemimaxilla was anesthetized. After ensuring that the indicated areas for surgery were adequately anesthetized (average waiting time 2.5 minutes), the sinus elevation procedure was performed. Parameters recorded were the success or failure of anesthesia, positive (blood) aspiration, bony obstructions in the greater palatine canal, and complications.

## RESULTS

The success of anesthesia administration was examined by probing the gingival buccal aspect of the hemimaxilla on the same side as the injection. Of the 76 MNB, 13 (17%) required an additional local infiltration of the anterior superior alveolar nerve, and in seven blocks (9.2%), an additional infraorbital nerve block was delivered. Positive (blood) aspiration was recorded in one block (Fig 3). There were no bony obstructions in the canal interfering with the needle pathway, and no complications were observed or reported during or after injection.

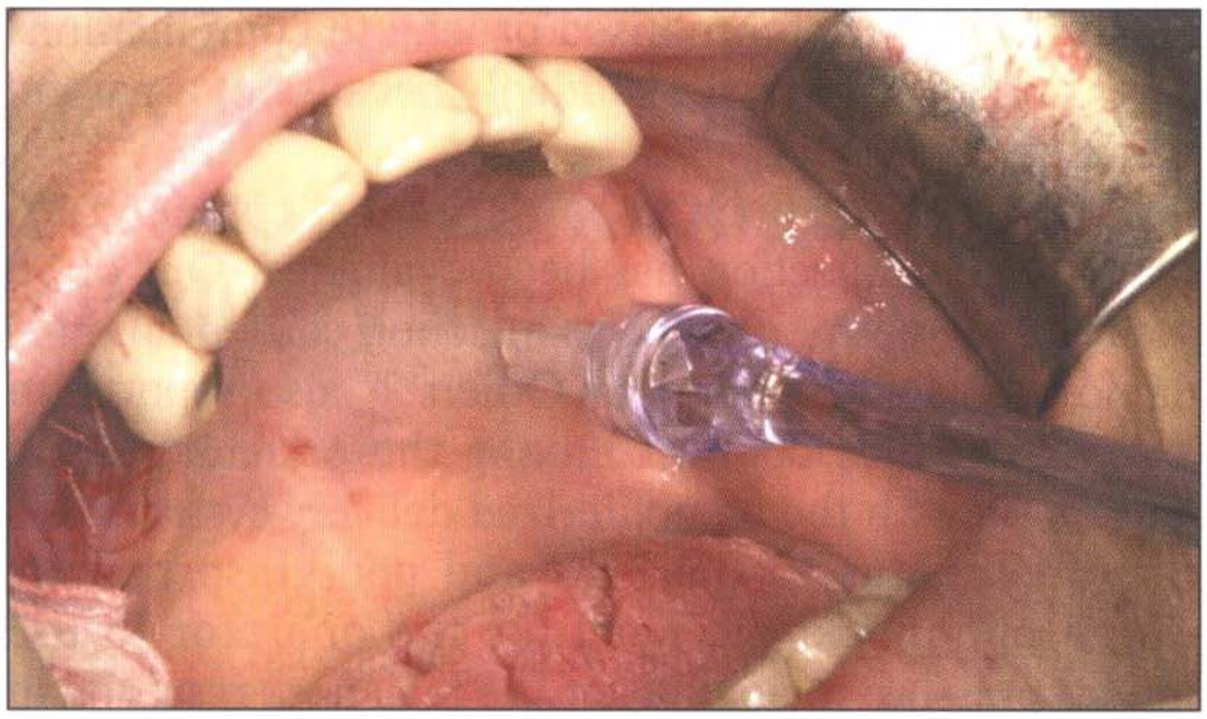


**Fig 3** Positive blood aspiration.

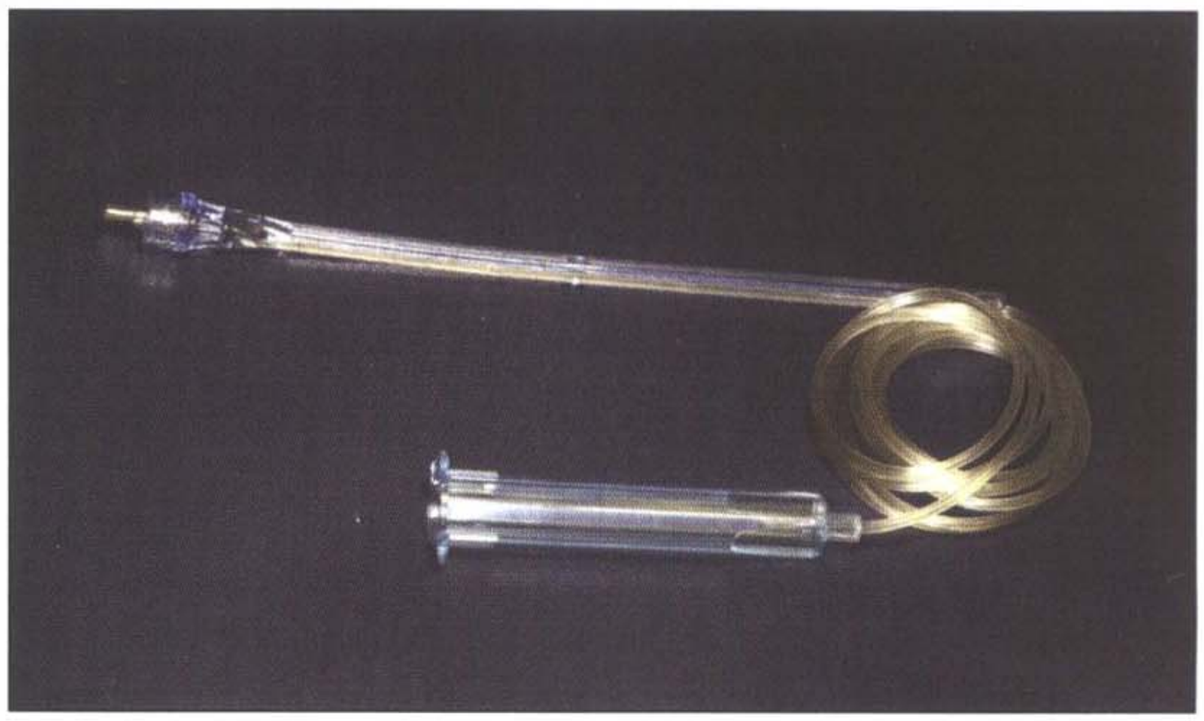


**Fig 4** The Wand handpiece, microtube, and cartridge holder.

## DISCUSSION

The maxillary nerve block compared to infiltration anesthesia provides a greater scope for surgery by anesthetizing the hemimaxilla with one needle penetration (injection site). Patients accept this approach better than a technique that requires several injections.[3] A common problem encountered with the use of the MNB technique is the inability to obtain profound anesthesia, which is frequently caused by the operator's inability to find the greater palatine foramen.[2]

The use of a handpiece (Fig 4), held like a pen, provides the operator with increased tactile perception and control of the needle and the needle bevel during placement. The slow-flow technology contained within the computerized delivery system enables a precise and automated control of the anesthetic flow rate, leaving the operator's hands free to hold the lightweight handpiece and insert it at the correct angle. Thus, the operator's ability to locate the foramen is greatly improved. The handpiece design also allows for rotation of the needle during penetration, resulting in a potential decrease in needle deflection.[4] The ability to rotate the needle during aspiration has been shown to increase the accuracy and decrease the possibility of inadvertent accidental intravascular injection.[5]

Partial anesthesia is not a technique-related problem. It is probably due to the high vascularity of the injected area or to the height of the maxilla being greater than the reach of the needle tip. Partial anesthesia has been described in 5% to 15% of the blocks using the traditional syringe as a delivery system.[6,7] Additional reasons for partial anesthesia are partial intravascular injection, collateral innervations, and insufficient volume of anesthetic solution. To minimize this occurrence, at least two cartridges (1.8 mL each) should be used, with a minimal waiting time of 2.5 minutes before beginning the procedure.

The computerized delivery system allows an empty cartridge to be replaced outside of the oral cavity without having to withdraw and reinsert the needle during injection. In this way, the two recommended cartridges can be delivered by a single penetration, thus, significantly decreasing potential complications. In addition, there is no need for cartridge sterilization when using this system because cartridge replacement is via an extraoral manipulation of the cartridge holder at a point far removed from the handpiece and needle.

It is of great interest that the interpretation of MNB is not uniform in the literature.[1,2,6,7] Success of MNB anesthesia has been described when the teeth, gingiva, and sinus, up to the first premolar on the ipsilateral side, is "completely anesthetized."[6] Success in the present study was recorded only when complete hemimaxilla anesthesia was achieved (up to the first incisor of the ipsilateral side). This difference can explain the relatively high rate of partial anesthesia in the present series.

Additionally, there was only one positive blood aspiration. The vessels within the canal, which are usually pushed aside as the needle advances, should be taken into consideration. If there is a positive aspiration, the needle should be slightly withdrawn and then readvanced.[1,2] Intravascular injection (positive blood aspiration) has been described as a complication in 8% of patients.[7] Other complications were nasal bleeding (epistaxis), diplopia (35%), strabismus (12%), ptosis (10%), constrictions in the canal (6%), and injury to neural tissue (1%). None of these occurred in this study.

It has been recommended that the operator acquire the patient's complete confidence and cooperation before attempting this block. The success of the

MNB could be compromised or lead to complications when the patient moves suddenly because of a painful stimulus.[2]

The subjective pain response from a computer-assisted palatal injection has been evaluated. Out of 50 dentists, 48 reported that this injection caused minimal or no pain for the patient.[8] Others[9,10] also reported a greater sense of comfort among the patients during anesthesia with the computerized delivery system. This is probably due to the light and pen-grasp handle, which eliminates the need for the operator to use thumb pressure to administer the injection, resulting in greater tactile feedback, precision, and operator ease.

## CONCLUSION

1. The computer-controlled anesthetic delivery system offers advantages over the hand-held syringe when the maxillary nerve block through the greater palatine canal approach is used.
2. With the required knowledge and respect for the associated anatomy, this technique should be considered with greater ease and more confidence, when indicated.

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