

## ABSTRACT

Although some issues have been raised anecdotally regarding the appropriateness of a computer-controlled anesthetic-delivery system for pediatric patients, very few reports are available or have been published on the reasons for and the use of this device for administration of local anesthetic in pediatric patients. Injections are often a primary source of fear and anxiety for young children visiting the dentist. Children may have had or heard of negative dental experiences from friends and others, and many children's dental horror stories revolve around "shots in the mouth." The sight of traditional manual injection systems, even a syringe, is obscured as completely as possible, also can elicit fussing and other unwanted behaviors among children, leading to a stressful dental experience for the child and uneasy treatment circumstances for the practitioner. In a pediatric dental practice, a great amount of effort may be required to appropriately manage a child who is uncomfortable and "fussy," thus necessitating the scheduling of more time per visit than normally required.

In a pediatric dental practice for children under 18 months, a computer-controlled anesthetic-delivery system for the administration of local anesthetic has had strong patient and parental acceptance. This system has been found to minimize patient discomfort and has reduced management difficulties during injection procedure. As a result, the child and their parents perceive a completely pleasant, positive dental experience, and in return visits, the patients show greater cooperation than in the past. The computer-controlled anesthetic-delivery system minimizes negative behaviors associated with anesthetic injection techniques.

## INTRODUCTION

The Wand® computer-controlled, local-anesthesia-delivery system (Milestone Dental, Inc., Deerfield, IL) was commercially launched to the dental market in October of 1997. Hochman and

co-workers have demonstrated in a controlled study that The Wand can comfortably and effectively administer local anesthetic, regardless of tissue density or resistance. The system's computer-controlled drive unit delivers precise pressure and volume ratios (flow rate) of anesthetic from standard cartridges and needles. The Wand incorporates a sterile, disposable handpiece assembly; the pen-like handpiece is configured to provide exceptional visibility and fingertip positioning accuracy as well as a non-threatening appearance, all of which have been found of particular benefit in the treatment of pediatric patients. In addition, the small size of the handpiece, which holds the needle, greatly facilitates access to areas such as the mandibular anterior segment, thereby simplifying the effective administration of anesthetic in sites where difficulties can be experienced in achieving optimal anesthesia for the extraction of deciduous teeth. Profound anesthesia also can be achieved in abscessed or otherwise infected teeth.

The system produces an anesthetic drip that precedes the needle, creating an anesthetic pathway<sup>1</sup>, which, in conjunction with the controlled flow of anesthetic, results in a virtually imperceptible injection and the rapid onset of the desired level of anesthesia. Used in combination with other anesthetics, such as topical anesthetic and nitrous oxide, this local-anesthesia delivery system significantly reduces patient discomfort during traditional infiltration-type injections as well as during other, less frequently employed (i.e., in pediatric dental care) techniques such as Modified Periodontal Ligament (PDL)<sup>2</sup>, Anterior Middle Superior Alveolar (AMSA)<sup>3</sup>, and Palatal Anterior Superior Alveolar (P-ASA)<sup>4</sup> injections.

A pre-puncture technique<sup>5</sup> specifically associated with the use of the local-anesthesia delivery system also works to alleviate patient discomfort. This technique is extremely difficult, if not impossible, to achieve with a traditional syringe-based injection system. Hochman and

# Using Computer-Controlled Technology to Alleviate Stress & Reduce Discomfort During Local-Anesthetic Delivery in a Pediatric Practice

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Friedman describe the technique as follows: placing the bevel of the needle against the surface of the tissue (against the palate for AMSA and P-ASA injections) and then using a sterile cotton-tip applicator to exert pressure on the end of the needle. The slow flow rate for anesthetic delivery is activated via the system's foot control for eight to ten seconds to provide surface anesthesia, and then the handpiece is slightly twirled until the needle pierces the tissue. Gently rotating or twirling the needle after producing surface anesthesia also eases a very slow needle penetration through tissue, improves accuracy, and simplifies precise positioning, thus enhancing the anesthetic effect desired.

#### APPLICATION IN PEDIATRIC DENTAL CARE

This anesthesia-delivery system has not yet been widely adapted in pediatric den-

tal practices, primarily, it appears, because of insufficient understanding of its cost-effectiveness and its benefits to patients. In searching for devices and systems that work effectively and efficiently with children, the goal should be to make children better dental patients and to make delivery of care to the patient as pleasant as possible, ultimately reducing stress and working time for the doctor and staff. If a patient is difficult and uncooperative, the experience is unpleasant for the patient, for the doctor, and for the staff.

One of the most difficult aspects of delivering care to young children is making them comfortable in such a way that does not cause discomfort. In my experience, the most effective way to treat a child in the dental environment is to make certain a procedure involves minimal or no pain. Oral pre-medication, nitrous oxide, and topical anesthetics can be employed prior

to administering local anesthetic, but patient apprehension and expectation of pain during injection procedures inevitably lead to perceptions of sensation of pain and the experience of discomfort.

A variety of anesthetic injection systems have been introduced over the years, all sharing the goal of reducing patient discomfort and enhancing precise delivery of the anesthetic solution. At one point, an air-driven device that had been developed to inject military inductees with vaccinations was considered an optimal replacement for needle-bearing syringes. This device used air to propel anesthetic into the oral tissue, and initially seemed to be a better technique for anesthetic delivery, primarily because no needle was involved; however, the device had inherent problems such as the noise and "kick-back" it produced during use. It also was cumbersome for the user. Furthermore, in the



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...system, it blew a small amount of air into the tissue, which, although not painful, was uncomfortable for the patient. The air became very soft after the anesthetic was removed.

More recently, a lidocaine patch for application to oral mucosa was launched on the market, but it too demonstrated limitations in pediatric dental practice. Although the anesthetic patch offers some value for adult patients, problems occur when using it on children. Pediatric patients tend to squirm and wiggle, and children have less buccal mucosa than adults do. Attempts to sufficiently dry a child's oral mucosa to accept the patch so it can produce the desired anesthesia have been found to be impractical.

Upon acquisition of the computer-controlled local-anesthesia delivery system for my practice in early 1998, I encountered colleague skepticism. As with any new technology, a learning curve is involved. Time is required, typically just a few weeks, to become acquainted with and accustomed to the product's characteristics, indications, and capabilities so it can be used efficiently during patient care.

With The Wand anesthesia-delivery system, it may be necessary to learn to slowly guide and insert the needle tip into the tissue. A small amount of topical anesthetic can be employed to numb the surface of the tissue. Then, after following the manufacturer's pre-puncture technique guidelines described above, the syringe tip is slowly guided into the tissue in the direction desired; once the specific injection site is attained, the anesthetic is delivered slowly, precisely, and at a controlled rate while the needle penetrates the tissue. This technique has produced excellent results in my practice, and patients have reported no discomfort.

Unlike the air injection device and the lidocaine patch, the computer-controlled local anesthetic delivery system provides a true infiltration injection. Because the actual anesthetic is delivered via a needle, it penetrates and reaches the areas where anesthesia is desired. In contrast to surface or top-

ical applications of anesthesia, which must migrate into the tissue, anesthetic delivered via this delivery system reaches the desired sites and locations, effectively producing the full anesthesia required for subsequent treatment procedures.

## BENEFITS IN PEDIATRIC DENTAL PRACTICE

Most of our pediatric patients (in fact, more than 80%) who, in the past, have been afraid of needles and very fearful during the injection of local anesthetic, have shown considerably less apprehension when The Wand has been used during their care. When it has been utilized to administer anesthetic during subsequent visits by individual patients, the patients have shown a marked level of comfort with the system and the technique associated with it. The patients are offered topical anesthetic as well as nitrous oxide in addition to the local anesthetic. After their initial introduction to The Wand and their realization of the comfort involved with the technique, many of them claim they no longer need nitrous-oxide sedation as an accompaniment to the local anesthesia. They have shown remarkable willingness to receive a new type of injection via a non-traditional delivery system.

Although some practitioners assert that they can provide a comfortable, non-stressful, controlled injection with a regular syringe system, their ability to achieve this on a consistent basis may be questionable. The computer-controlled system delivers a precise, measured amount of anesthetic in a very slow, deliberate, and controlled fashion, one-drop at a time, each time it is employed. The device prevents the rapid deposit of large amounts of anesthetic, which eliminates what many consider the most uncomfortable part of the injection, that is, the pressure created when too much anesthetic is delivered too quickly. Using a system that delivers the anesthetic solution in a slow, deliberate fashion tends to dramatically reduce discomfort related to the injection.

When employed with topical anesthetic,

the gentle pre-puncture technique, and the slow rate of anesthetic flow, tissue can be effectively anesthetized with minimal patient discomfort, and according to many patients, the procedure is virtually painless. Although some patients will complain of pain during any procedure and some will never be fully comfortable with an injection, many of these patients ultimately admit that they felt virtually nothing during the injection, adding that they were simply afraid of it. The anticipatory fear is a greater cause of poor behavior than is the pain of the injection.

As with all injection techniques, devices, and compounds, one of the major problems is residual numbness following treatment. Pediatric patients tend to be unaccustomed to and uncomfortable with numbness, and many parents seem unable to understand why their children complain of discomfort after a procedure has been completed. In my opinion, children complain as much about the sensation of being numb as they do about any of the preceding treatment procedures. Being numb is a very uncomfortable and unusual feeling for young children who haven't previously experienced it and thus don't understand the sensation or lack of sensation. The new palatal injections, (AMSA and PSA) provide profound pulpal anesthesia without collateral anesthesia to the patient's lip and face.

As a related aside, when children are treated in an operating room setting and placed under general anesthesia, the anesthesiologist often wishes to give them a little local anesthetic, so when the child awakens the treatment site in the mouth is not uncomfortable. This method, however, does not address the child's discomfort with the numbness, and although we want to minimize post-operative pain as much as possible, many patients find residual numbness to be worse. In such instances, acetaminophen or another medication that reduces the discomfort may be a better solution than a local anesthetic.

## PATIENT RESPONSE & TREATMENT CHALLENGES

After undergoing administration of local anesthetic with The Wand, many patients in my practice report that it was "the best injection" they ever had, and they show a willingness to return for subsequent treatment. Afterwards, the children often say "It wasn't as bad as I thought. I heard it was going to hurt." Some even say, "Gee but was great," or "I didn't feel that." I simply reply, "I don't want you to feel it." Once the patients move beyond their fearful anticipation of the injection, which is possible after experiencing anesthetic administration with the computer-controlled system, our experiences with patient management have been largely positive and pleasant, even with patients requiring extractions.

On many occasions, children present with over-retained teeth, that is, they have retained deciduous teeth behind the newly erupting permanent teeth. In the lower anterior region, it is particularly difficult to achieve sufficiently profound anesthesia to remove the over-retained deciduous teeth without producing trauma to the patient. By using The Wand and infiltrating around the teeth, the patient experiences little or no discomfort, and difficulty in extracting the teeth is minimized.

Another area in which the local-anesthetic delivery system has been particularly beneficial is in cases involving abscessed or infected teeth, which, with a traditional injection system and technique, are almost impossible to anesthetize to a level at which patients experience minimal pain during treatment. The Wand allows infiltration down to the roots of the teeth, particularly when using it in a PDI injection technique.

In cases involving "difficult" children, the system has proven of immense value. The Wand system is not as visually threatening to children as is a traditional injection system, even though most pediatric dental practitioners are aware that it is not a good idea to flaunt a needle in front of the

patient. Nonetheless, a staggering array of currently used dental products such as composites and etching gels utilize syringe-type delivery systems, and simply the sight of a syringe evokes fear in many children (and in young adults as well). Despite reassurances that no needle is involved with such products, the fact that something looks like a syringe evokes fear and apprehension. Because the Wand system's handpiece does not resemble a syringe, it seems not to elicit the same perceptions and fear. Additionally, it is perceived as a "high-tech" device. With children now knowing more about computers than many of their parents, when they learn that a computer-based, computer-controlled anesthetic system will be used, they want to see what it's about.

Parents' responses and acceptance of The Wand have been as positive as their children's in virtually all instances, a result, perhaps, of understanding that their children are no longer as fearful of injections as they were in the past. Parents also positively perceive the newness and the modernity of the device and seem to appreciate the practice's efforts toward reducing fear and alleviating discomfort during their children's dental visits.

Our practice sees patients who range from newborns up to about age 18, in addition to handicapped adults. Almost every patient who has the ability to report a reaction has responded well to the new injection system, but the most positive responses have come from teenagers, those between the ages of 14 and 16, who were once fearful of sitting in a dental chair without first receiving nitrous oxide. For teenage patients, reading the informational brochures on The Wand generates curiosity, and if they require an injection of local anesthetic, they want it to be used. Thus far, none of these patients has been disappointed.

Although the computer-controlled local-anesthetic delivery system appears to be more expensive than a traditional system, weighing the fuss and discomfort associat-

ed with traditional injection systems against the benefits perceived by the patients, the reduction of patient discomfort, the convenience afforded by the system, and the consistency in its operation renders the economics of investing in this new technology almost negligible. The savings in time involved to effectively and consistently achieve the desired level of anesthesia and the reduction in stress for the operator giving the injection are additional factors to consider when evaluating the technology. The time savings more than compensate for the extra cost of the device.

The most difficult part in the delivery of dental care is making the patient comfortable. In most cases, once a patient is comfortable and calm, work proceeds without disruption. When patients fuss or exhibit other difficult behaviors, they remain difficult until the anesthetic has taken effect. The difficult behaviors tend to be a result of preconceived notions about dental treatment or a result of previous negative experiences and are exhibited because the patient expects an unpleasant experience. Once these patients have a pleasant dental experience, that is, one without pain or discomfort, their entire attitude changes and the difficult behaviors disappear, resulting in a more positive situation for both the practitioner and the patient.

The philosophy behind The Wand local-anesthetic delivery system is very simple: It is basically a method that numbs children and delivers the anesthetic in a slow, deliberate fashion. The pressure and hence the pain involved in anesthetic delivery are no longer perceived or present. The Wand system can be utilized for traditional and nontraditional injections; the traditional injections have the same traditional side effects, and while this won't change, the discomfort is significantly minimized.

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