CLINICAL APPLICATION OF JET INJECTION TO COMPREHENSIVE PAIN CONTROL

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In a previous paper,[1] the results of a study utilizing a spring-powered jet injection device for the production of local anesthesia without the use of a needle were reported. The instrument, the Syrijet Mark II (Mizzy, Inc., N. Y.) has several advantages over other jet injection devices currently available in that it accepts all standard 1.8 cc cartridges of local anesthetic solution and permits the administration of a variable volume of solution, as well as being completely autoclavable. Subsequent to the publication of the study referred to previously, the authors have had the opportunity of evaluating several modifications of the instrument and have discussed variations in technique and results with many dentists currently using the instrument. Accordingly, it has been found that broader application and virtual elimination of all side-effects previously reported were made possible by continued refinement in technique and careful attention to details of use. Since the Syrijet probably enjoys the widest use of any of the jet injectors, and since the side-effects, although not serious in consequence, can be annoying and recur with a fair degree of regularity; it is of value to review the various techniques available for broadening the applications of the instrument and eliminating potential side-effects.

Discussion

Most all of the side-effects encountered are based on misuse of the instrument by the operator. The biggest single problem seems to be an attempt by many operators to duplicate with the Syrijet the conditions of injection when using an ordinary syringe and needle. As a result, the operator will incorrectly point the instrument toward the apex of the tooth (often at an angle, as with a needle syringe), and, because he feels that the success of the injection is directly related to the amount of anesthetic solution deposited in the tissues, he will turn up the volume setting on the instrument as high as he can. Since a jet injection device propels local anesthetic solution into tissue very rapidly by means of mechanical spring pressure and operates quite differently from a conventional needle and syringe, a reorientation in approach to instrumentation is required on the part of the operator in order to get maximum effectiveness.

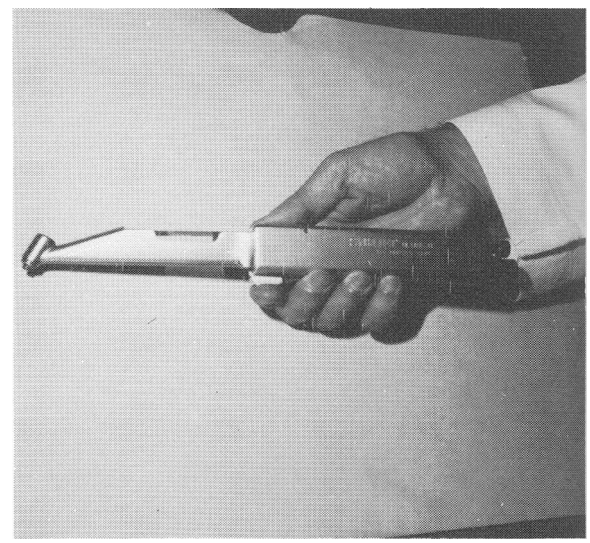

Figure 1
Syrijet is held firmly.

The instrument should rest firmly in the hand, with the fingers around it, (Fig. 1). Since pressure against the tissue is contraindicated, a finger rest can be used on the under surface. The nozzle should be directed at the *attached gingiva* as high as possible at right angles to the tissue. Except for palatal injections, all injections should be in attached gingiva. The nozzle should rest gently against the tissue, and not be

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pressed up firmly against it. If the nozzle is pressed against the tissue, or is pushed with thumb pressure at the time of the injection, a hematoma may be formed. There is also some tendency to move the instrument away from the tissue or direct it at an angle at the time of injection, in which case a blasting or slicing effect would be created. The lip should be lowered around the instrument so as not to stretch the tissue during the injection, and kept lowered immediately following the injection. The site should be dried just prior to the injection, since dry tissue will accept solution more readily, and dry tissue will inhibit the instrument from sliding and going off at an angle. It is not necessary to inject more than the optimal quantity of solution—no more than 0.1 cc is required for upper anterior teeth, 0.15 cc for lower anteriors or a mental nerve injection, and 0.05 cc for all lingual or palatal injections. Whenever necessary, multiple injections can be made using the quantities indicated, and any local anesthetic solution with a vasoconstrictor can be used. Using higher quantities of solution does not yield better results, but instead can cause bleeding, ballooning and tearing of tissue as well as postoperative soreness.

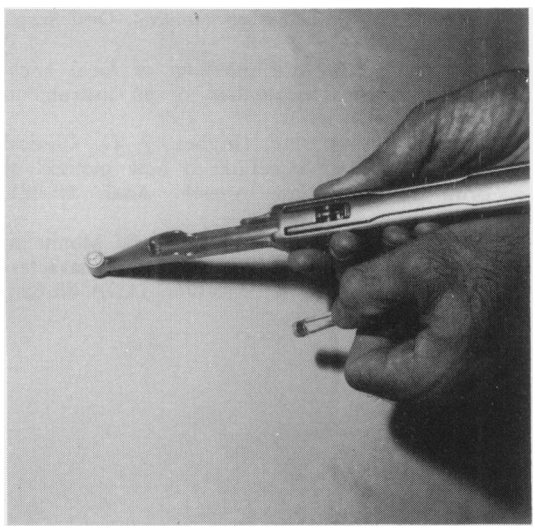

Figure 2

Needle which pierces rubber diaphram of the anesthetic cartridge.

While jet injection procedures are "needleless" with regard to the patient, there is a needle inside the instrument which pierces the rubber diaphragm of the cartridge of local anesthetic solution (Fig. 2). It is important not to bend this needle, because if the needle is bent it may bring the bevel of the needle up against the glass wall of the vial, causing an incomplete filling of the liquid chamber upon cocking, as well as the production of air under pressure in the well. Accordingly, the cartridge of anesthetic solution should be inserted into the cartridge well parallel to the long axis of the instrument (Fig. 3) and then moved

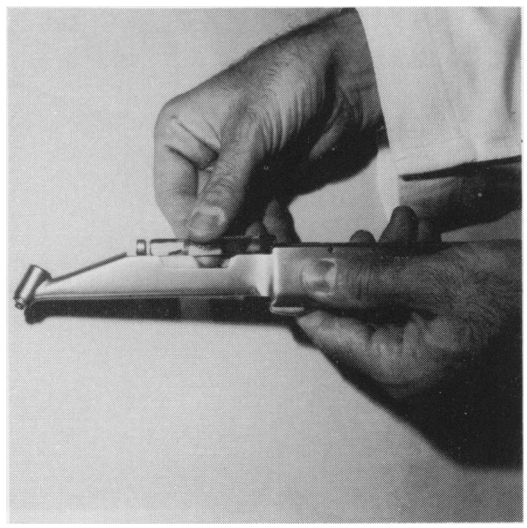

Figure 3

Anesthetic cartridge is inserted parallel to the axis of the Syrijet.

up onto the needle, instead of being inserted at an angle onto the needle (Fig. 4). This same procedure, in reverse, should be used in removing the cartridge. A bent needle can also cause leakage of the local anesthetic solution, with resultant crystallization on the instrument. If this occurs, while it will not cause corrosion, it should be washed and rinsed with soap and water, keeping a cartridge in the instrument during washing.

When properly used, the Syrijet jet injector provides adequate anesthesia for the successful performance of many soft tissue procedures and for the removal of deciduous teeth and most anterior permanent teeth, as well as for many minor oral surgery procedures in which it is more convenient than conventional local anesthesia with needle syringe.[1,2,3] The device has also been used under severely adverse conditions, such as in a jungle environment, and interestingly enough, there has appar-

ently never been a reported case of infection stemming from the use of the jet injector.[4] The standard instrument has a nozzle pressure of 2,000 pounds per square inch (psi), and at this pressure it was found that jet injection of local anesthetic solution provides penetration and infiltration roughly comparable to that produced by needle injection to near 1 cm depth, with quantities up to 0.2 ml per injection.[5]

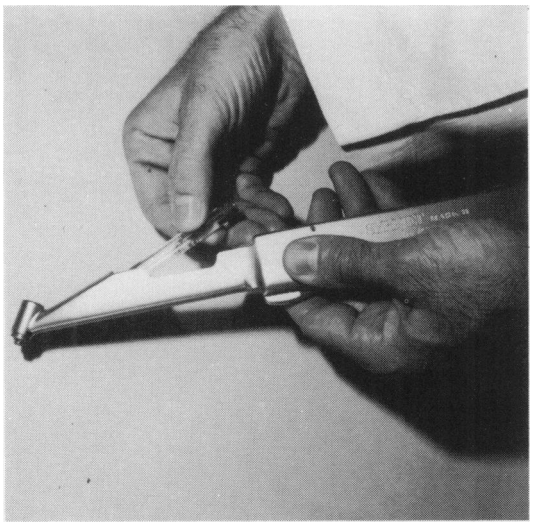

Figure 4

Incorrect anesthetic cartridge placement.

For the past year, the authors have been evaluating instruments that have been modified to provide greater pressures (up to 3,000 psi) and to deliver greater volumes of solution (up to 0.35 cc), in an effort to determine whether it would be beneficial to alter these variables. Although these studies are still in progress, it can be stated that for the most part, it has been found that the standard model currently in use is most adequate for virtually all applications, and is in fact superior to the modified models for some applications. As previously reported, it has been found to be particularly useful when applied to children or adults who are fearful of the conventional needle syringe, or for those who would often rather tolerate the discomfort of a relatively minor procedure (such as the removal of fracture arch bars) than be subjected to the puncture of a needle.

Summary and Conclusions

As a followup to a previous paper on the use of the Syrijet automatic jet injector, broader application of the instrument and virtual elimination of all reported side-effects are made possible by careful attention to details of proper use and by refinement in technique. Also, evaluation of modified models which permit the use of increased pressures and greater volume delivery of anesthetic solution indicate no advantage, for most applications, over the standard model currently available.

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