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Editor:

ROBERT B. SHIRA, D.D.S.

School of Dental Medicine, Tufts University

1 Kneeland Street

Boston Massachusetts 02111

The periodontal ligament (PDL) injection: An alternative to inferior alveolar nerve block

Stanley F. Malamed, D.D.S., Los Angeles, Calif.*

UNIVERSITY OF SOUTHERN CALIFORNIA SCHOOL OF DENTISTRY

The periodontal ligament (PDL) injection for mandibular anesthesia in isolated regions was evaluated, using both a conventional syringe and two devices designed for this procedure. A high success rate was achieved, with a low incidence of adverse reaction and highly favorable comment from both patients and administrators. Duration of pulpal anesthesia following the technique described proved adequate for most dental procedures. The newer devices appear to have some advantage over the conventional syringe technique. However, the PDL injection technique can readily be used with any conventional syringe. Further study is recommended to determine the response of periodontal and pulpal tissues.

The field of pain control in dentistry was for many years in a state of inertia. From the time of the development and introduction of the amide type of local anesthetics in the 1940's and 1950's, and the development of the single-use cartridge system (1950's), little change took place in this extremely important area of dental practice. Of late, however, several potentially significant advances in local anesthetic technique and armamentarium have been introduced. Included among these are several highly promising long-acting local anesthetics, bupivacaine and etidocaine; a new self-aspirating syringe†; and new approaches in technique for the

mandibular and inferior alveolar nerve block.^{1,2} These additions to the dental profession's armamentarium for the control of pain have had a beneficial effect on the management of many dental patients. Yet, in spite of these innovations, attaining clinically adequate pain control in the mandible can still prove to be a difficult problem to solve.

Because of the nature of bone in the adult mandible, pain control for most dental procedures in the mandible requires the use of one of the available regional nerve blocks: the inferior alveolar, the Gow-Gates,¹ the Akinosi,² or the incisive (mental) nerve block. One of the advantages of these techniques is the extent of anesthesia they provide. For extensive procedures involving up to a quadrant, these nerve blocks are recommended. There are patients, however, in whom these tech-

*Associate Professor, Section of Anesthesia and Medicine.

†Astra Pharmaceutical Products, Inc., Framingham, Mass.

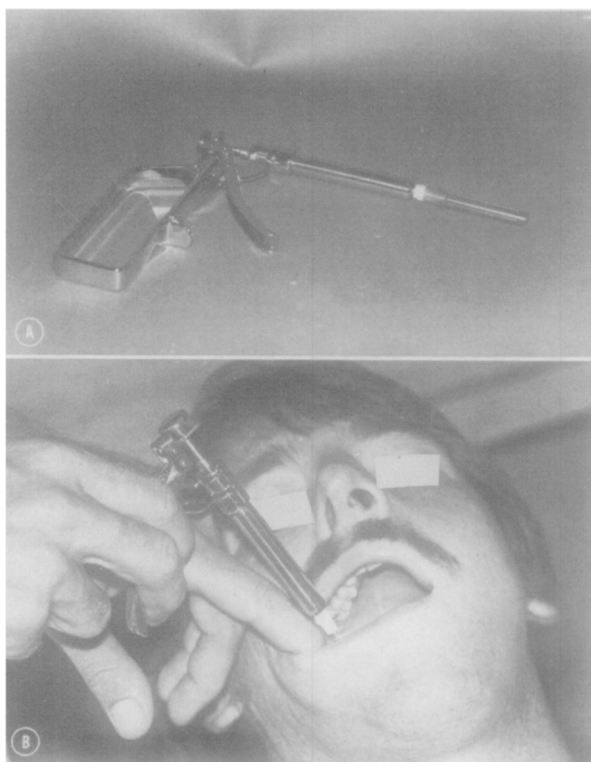


Fig. 1. A, Peri-Press syringe for PDL injection. B, Each "squeeze" of trigger of Peri-Press deposits 0.2 ml. of anesthetic solution.

niques may be contraindicated. These include the hemophiliac patient,³ or others with bleeding disorders, in whom postinjection bleeding may be dangerous and young children and mentally or physically handicapped persons in whom the risk of postinjection soft-tissue trauma to the still anesthetized tongue or lower lip is increased.⁴ In addition, many dentists have sought a means of providing consistently reliable pain control in isolated regions of the mandible for short procedures on one or two teeth without having to anesthetize the entire quadrant and soft tissues to do so. Two techniques, the intraosseous⁵ and the interseptal⁶ (intrapapillary), have been used with some success for many years. These techniques, however, have not proved to be successful consistently enough to gain mass acceptance.

THE PDL INJECTION

A technique called the periodontal ligament (PDL) injection (intraparodontal or intraligamentary) has also been employed for many years, primarily as a means of achieving complete anesthesia in a tooth where regional block anesthesia had previously failed to provide it.⁷ Typically, this injection was employed when the mesial aspect of the



Fig. 2. To achieve anesthesia of first molar, separate injections are required on the mesial and distal roots.

Table I. Summary of dental procedures

<i>Procedure</i>	<i>No.</i>
Restorative	71
Crown preparation	12
Endodontics	8
Periodontics	7
Extraction of tooth	2

mandibular first molar remained sensitive to stimulation although the remaining portions of the tooth were quite insensitive. The needle was placed into the gingival sulcus along the mesial root of the tooth and advanced down along the root until resistance was encountered. Approximately 0.2 ml. of local anesthetic solution was deposited and the dental procedure could continue within 1 minute. Significant success was achieved in this manner.

In the late 1970's two new local anesthetic devices—the Peri-Press* and the Ligmaject†—were introduced in the United States (Fig. 1). Both claimed to permit the administrator to achieve profound pulpal anesthesia in single mandibular teeth without the need for regional nerve block and without anesthetizing the lower lip and the tongue. If possible, the PDL injection might well prove to be an important addition to the armamentarium for the control of clinical pain in dentistry.

This article reports the findings of a small clinical study on the effectiveness of the PDL injection in achieving clinically adequate pain control for a variety of dental procedures, with and without the use of these new syringes.

*Universal Dental Implements, P.O. Box 254, Fanwood, N. J.

†I.M.A. Associates, U.S., Inc. 270 South Harvard Blvd., Los Angeles, Calif.

Table II. Results by procedure

Procedure	PDL syringe		Conventional syringe		Total	
	No.	Percent successful	No.	Percent successful	No.	Percent successful
Periodontal	5	100	2	100	7	100
Tooth extraction	1	100	1	100	2	100
Restorative	45	93.3	26	88.4	71	91.5
Crown preparation	5	60	7	71.4	12	66.6
Endodontics	5	60	3	33.3	8	50
Total	61	88.52	39	82.05	100	86

Table III. PDL Success rate by local anesthetic

Anesthetic	No. of PDL	Percent successful
Lidocaine 2 percent		
1:50,000 epinephrine	9	77.7
1:100,000 epinephrine	44	93.1
Mepivacaine		
3 percent	19	84.2
2 percent + 1:20,000 levonordefrin	8	75.0
Prilocaine 4 percent		
Plain	11	81.8
1:200,000 epinephrine	9	77.7

PDL TECHNIQUE

The PDL injection technique was used on 100 adult patients who required mandibular anesthesia for various dental procedures (Table I). The injection technique follows: with the Peri-Press or Lig-maject syringe, the 30-gauge needle recommended by their manufacturers is inserted into the gingival sulcus on the mesial aspect of the tooth to be anesthetized. The needle is advanced in the sulcus until resistance is met. The trigger of the syringe is slowly pulled, depositing approximately 0.2 ml. of anesthetic solution. In our experience, there must be resistance to the deposit of solution for the PDL injection to prove successful. If the solution appears to flow readily into the patient's mouth, the operator should reinsert the needle and inject again.

For multirooted teeth, the procedure should be repeated on the distal root. When root planing or other periodontal or surgical procedures are planned, additional solution is required on the buccal and lingual surfaces.

After only a few PDL injections with these devices, we observed that many of the 30-gauge needles were bending upon insertion into the gingival sulcus. We elected to use 25- and 27-gauge short needles for the remaining injections, and this entirely eliminated the problem of bending.

Table IV. Patient preference of technique

Technique	Percent
PDL injection	74
Inferior alveolar	26

With a conventional cartridge type of syringe, a 25- or 27-gauge short needle was employed. There were no incidents of needle bending with these needles. The technique of PDL injection is identical to that described above. The administrator must apply considerable pressure to the thumb ring of the syringe in order to force solution into the tissues of the periodontal ligament. Although it did not occur during our study, there was considerable concern over the possibility of the glass cartridge shattering when exposed to the pressure required to deposit the 0.2 ml. of anesthetic solution. This represents one advantage of the newer syringes in which the cartridge is enclosed in either a metal or Teflon sleeve, eliminating the danger to the patient of a broken glass cartridge. It should be noted also that no cartridges shattered with either technique, although I have received anecdotal reports of such occurrences. One other factor concerning the PDL injection with a conventional syringe was that several administrators had significant difficulty in applying pressure adequate to force the anesthetic solution into the tissues. With the PDL syringes, this problem was nonexistent.

RESULTS (TABLES II TO IV)

The PDL injection was employed for seventy-one restorative procedures on mandibular posterior teeth (premolars and molars). Procedures consisted of tooth preparation for alloy or gold restorations. Successful pulpal anesthesia was achieved in sixty-five cases. Successful anesthesia was considered to be Grade A anesthesia, according to the system devised by Dobbs and DeVier,⁸ in which completely satisfactory anesthesia is obtained.

Eight of twelve teeth being prepared for crowns achieved Grade A anesthesia. When used for periodontal procedures, such as curettage and root planing, all seven PDL injections proved successful, as was the case for two extractions of mandibular teeth (second premolar and second molar). For periodontal and surgical procedures, supplemental injections (PDL) were required on the buccal and lingual surfaces.

The only significant degree of difficulty in achieving clinically adequate pain control occurred in endodontic cases, where only four of eight PDL injections achieved Grade A anesthesia. In all cases teeth had vital pulps and had been quite sensitive prior to treatment.

The duration of clinically adequate pulpal anesthesia was approximately 30 to 45 minutes. All available local anesthetic solutions were used in a random manner. There appears to be little difference in success rate by drug used (Table III); nor was there any significant difference in the duration of action.

Patients were asked their preference of technique between the inferior alveolar nerve block and the PDL injection. The overwhelming majority favored the PDL injection (Table IV). Patients favoring the inferior alveolar nerve block were those in whom difficulty was encountered in obtaining adequate pain control with the PDL injection; one patient who experienced exquisite discomfort during the injection and two who mentioned discomfort occurring the day following the procedure.

Those who administered the PDL injections commented that patients' responses during the procedure were more subdued than those normally encountered during inferior alveolar nerve block.

ADVERSE REACTIONS AND COMPLICATIONS

Few adverse responses were noted in our patients. One patient with highly inflamed gingival tissues experienced considerable discomfort during the PDL injection, in spite of topical anesthetic and nitrous oxide-oxygen inhalation sedation. Two other patients, both of whom underwent "minor" restorative procedures, experienced discomfort after the anesthetic effect had resolved. They described the tooth as being "sore" or "high," as though they were biting on it too soon. A check of the occlusion showed prematurities, correction of which led to almost immediate relief of symptoms.

Follow-up for as long as 6 months in several patients had not demonstrated any long-term reactions to the PDL injection technique.

DISCUSSION

The need for single-tooth anesthesia in the mandible has led to the development of a number of techniques aimed at this goal. Of these techniques, the periodontal ligament injection appears to be the most consistently reliable in achieving clinically adequate pulpal anesthesia.

The success rates of the injection, when used with a conventional syringe or the newer syringes designed for this injection, are similar. There are some factors, however, which appear to recommend the use of these devices. The major factor is the ease with which the PDL injection may be administered when compared to the conventional syringe. Indeed, several administrators in our study were unable to deposit an adequate volume of local anesthetic solution with a conventional syringe. A second possibly significant factor in favor of these devices is the protection afforded the glass cartridge. Because of the severe pressure to which the cartridge is subjected during injection, the possibility of glass breakage exists. While this did not occur during our study, I have heard of a number of such occurrences. The Peri-Press syringe has a metal sleeve protecting the cartridge, while the Ligmaject has a Teflon sleeve covering its cartridge. Third, each "squeeze" of the trigger of these devices deposits a fixed volume of anesthetic solution, (0.14 ml. for the Peri-Press, 0.2 ml. for the Ligmaject), which has proved to be an adequate volume for Grade A pulpal anesthesia.

The only negative findings to date have been minor and, to a degree, correctable. First, the manufacturers of both syringes recommend the use of a 30-gauge short dental needle. In the present study it was found that a high percentage of these needles bent on insertion into the gingival sulcus. Use of either a 25- or a 27-gauge short needle eliminated this problem and did not prove to be any more uncomfortable for the patient.

Second, and of lesser significance, both syringes look like guns, and several of our patients commented on this fact. Proper preoperative discussion with an apprehensive patient can minimize this cause for concern.

There appears to be no more discomfort during PDL injection than that experienced with the conventional inferior alveolar nerve block. Many patients commented on the lack of discomfort with the PDL technique. Other positive findings are the presence of clinically adequate mandibular anesthesia without concurrent anesthesia of the tongue or lower lip, which is routinely achieved with this

technique, and the positive aspiration rate of 0 percent.

CONCLUSIONS

New devices now on the market offer a means of achieving isolated regions of mandibular anesthesia without the need for regional nerve block techniques. In a small clinical trial we evaluated the effectiveness of these devices and of a conventional syringe technique for the PDL injection. Grade A pulpal anesthesia was obtained in more than 85 percent of all patients undergoing a variety of dental procedures with both techniques. The only area in which difficulty was met in achieving pain control was in endodontic treatment. Duration of pulpal anesthesia following injection of 0.2 ml. of solution along each root of the tooth was approximately 30 to 45 minutes with a variety of agents. Adverse reactions appear to be minimal. Several patients experienced slight discomfort several hours later, and most patients stated that they preferred the PDL injection to the inferior alveolar nerve block.

In conclusion, in an admittedly small clinical trial, the PDL injection appears to be a successful alternative to the conventional nerve block techniques for mandibular anesthesia. Both the newer devices and the conventional syringe techniques have proved effective, with few side effects. Further

studies are required to determine the possible effect of this technique on the status of the periodontal ligament and on the status of the pulpal tissues, especially when vasoconstrictors are added to the local anesthetic solution.

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Reprint requests to:

School of Dentistry
University of Southern California
P.O. Box 77951
Los Angeles, Calif. 90007