

A Clinical Evaluation of the Periodontal Ligament Injection

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الخلاصة

الأهداف: تم تقييم طريقة التخدير الموضوعي بطريقة حقن المادة المخدرة في داخل النسيج الرابط حول السن (P.D.L.) في مناطق معزولة من الفك الاسفل بأستعمال آلة الحقن التقليدية في طب الاسنان **والمواد والطرائق:** تمت الدراسة السريرية على 100 مريض كانوا بحاجة الى قطع لأحد أسنانهم الخلفية. **النتائج:** أظهرت النتائج نسبة عالية من النجاح (85%) ولكن في نفس الوقت انتقدت الطريقة من قبل المريض من ناحية كونها طريقة مؤلمة. كانت مدة التخدير كافية بعد الحقن في معظم الحالات **الاستنتاجات:** هنالك الات جديدة في الاسواق صنعت خصيصا لهذه الطريقة ولكن لسوء الحظ لم تكن متوفرة في مكان اجراء الدراسة. تقترح الدراسة اجراء بحوث أكثر لغرض تقييم الطريقة بصورة جيدة وكذلك لتقييم تأثير هذه الطريقة على النسيج الرابط ما حول الاسنان وكذلك على النسيج الليي الموجود في داخل السن في حالة أستخدام هذه الطريقة في العلاجات التحفظية للاسنان كالتيجان، الجسور والحشوات.

ABSTRACT

Aims The periodontal ligament injection in isolated areas of the mandible was clinically evaluated using only a conventional dental cartridge syringe. **Materials and Methods:** One hundred subjects requiring extractions of either premolars or molars participated in the study. **Results:** A high percentage of success rate (85%) was achieved but with unfavorable comment from the patient in regard to a painful injection. Duration of surgical anesthesia following the injection proved to be adequate in almost all extractions performed. **Conclusions:** New devices for performing this injection appear to have some advantage over the conventional syringe technique. However, these devices were unfortunately unavailable at the area of study. Further studies are recommended to further evaluate its success and also to determine the response of both the periodontal ligament and pulpal tissue in cases were restorative treatment of teeth is to be undertaken for example crowns, bridges and fillings.

Key words: Periodontal ligament injection, Local anesthesia.

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INTRODUCTION

The relief and prevention of pain has been one of the main objectives in dental practice^(1, 2). From the time of development and introduction of the amide type local anesthetic agent in the 1940^s and 1950^s and the development of the single use cartridge (1950^s), little change took place in this extremely important aspect of dental practice⁽³⁾. Later on, significant advances in local anesthetic techniques and armamentarium have been introduced; among these were new approaches in technique for the mandibular nerve^(4, 5, 6, 7). As well as maxillary nerve block techniques, one of the advantages that these

approaches provide is the wide extent of anesthesia achieved following the injection^(8, 9). These techniques are best recommended for procedures involving up to a quadrant of a jaw. However, there are certain situations in which the adoption of these techniques may be contraindicated such as in young children and mentally or physically handicapped persons who are prone to self-inflicting post injection soft tissue trauma of the still anesthetized tongue or lower lip that lower nerve blocks provide^(8,9). In addition, there are situations in which the adoption of these techniques may be dangerous as in pa-

tients suffering from a bleeding disorder such as hemophilia in whom post injection bleeding following such an injection may be fatal^(10,11,12). In this regard, many dentists have found a means of providing pain control in isolated areas of the mandible or maxilla for short procedures on one or two teeth in one quadrant such as the intraosseous, intraseptal and periodontal ligament injections without the need to anesthetize the entire quadrant and soft tissue surrounding the teeth^(13, 14, 15, 16). These techniques could either be used as a primary injection or as a supplemental injection with infiltration of block techniques to achieve profound anesthesia⁽¹⁾.

By definition, the periodontal ligament injection (P.D.L.) injection is a form of infiltration anesthesia which became popular in the 1980^s whereby a small volume of local anesthetic solution is delivered under pressure into the limited P.D.L. space of the single tooth involved where the solution will diffuse apically through the ligament space and adjacent marrow space to anesthetize the tooth to be treated on^(8,9).

This study evaluated the P.D.L. injection as a primary injection for mandibular anesthesia. The evaluation was based on certain criteria which included pre and post injection pain, time of onset of anesthesia, time of surgical anesthesia, grade of anesthesia, and any possible post- injection complications.

MATERIALS AND METHODS

The armamentarium adopted for the study included the following:

1. Conventional non-aspirating stainless steel dental cartridge syringe.
2. Local anesthetic solution of standard expiry date (2.2ml lidocaine HCL with 1:80.000 adrenaline).
3. Disposable QD short length (16mm) gauge 27 dental needle.
4. Examination set (mirror, probe, tweezers)
5. Cotton.
6. Stop watch.
7. Surgical instruments.

Method: The study was adopted on 100 subjects of different sexes and ages ranging from 18-41 years. The study was conducted in the Department of Oral Surgery / Dental faculty /Mosul University. All of the subjects chosen were medically fit, had no previous history of allergic reactions to local anesthetic solution, the site of injection was free from any acute inflammation and were informed of the purpose of study before it was commenced. After a final diagnosis, the teeth involved all indicated for extraction. For standardization, the teeth selected were lower premolars and first molars. For the purpose of comparison, 20 subjects out of the total 100 patients participating in the study were considered as a control group and only received the conventional inferior dental block technique as a primary injection. To avoid operator mediated errors, all the injections were performed by the researcher. The cartridge that was to be used to deliver the solution was calibrated at 0.2 ml as shown in Fig (1) below.

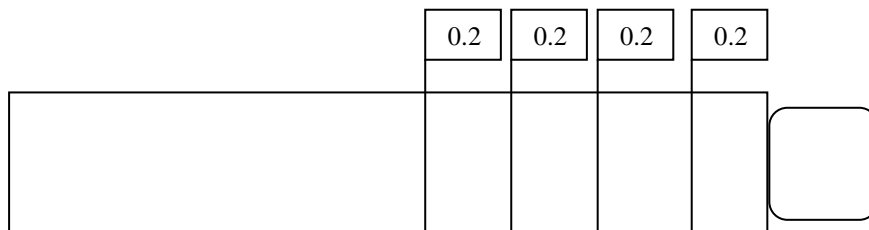


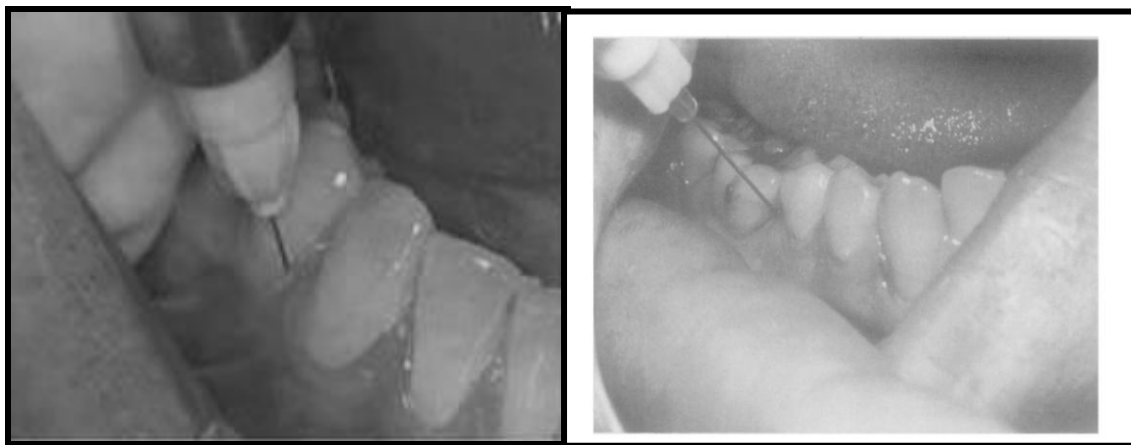
Figure (1)

This calibration referred to the volume that was to be injected in each aspect of the tooth to be extracted (mesial, distal, buccal and lingual sides). The steps of the PDL technique as recommended by ⁽¹⁾ was performed on 80 subjects of the total 100 and as follows:

1. With the calibrated dental cartridge loaded into the conventional dental syringe and a short 27 gauge needle adapted to it, the needle with its bevel facing towards the root of the tooth involved was advanced into the gingival sulcus until resistance was met.
2. After the syringe was correctly placed

inside the P.D.L, the piston of the syringe was slowly advanced depositing under pressure a volume of 0.2 % in each aspect of the tooth to be extracted (mesial, distal, buccal and lingual aspects).

3. For optimal success, there had to be resistance to the deposition of solution. Any solution which appeared to flow readily into the patient's mouth were considered as a failure and the needle was reinserted once again and solution reinjected once again.
4. To avoid bending of needle on injection, a short dental needle was adopted. The approach is shown in figures (2 and 3).



Figures (2) and (3): The periodontal ligament injection

5. Following the deposition of last volume of solution into the tooth, the stopwatch was turned on to record time of onset and achievement of surgical anesthesia. Onset in seconds or minutes was assessed by probing the gingival tissue around the tooth to be extracted until pain sensation had vanished. Time of surgical anesthesia was assessed by placing the surgical instrument (forceps or elevators) on the tooth. Total anesthesia in seconds or minutes was recorded when complete pain sensation on extraction had disappeared.

Besides onset and time of anesthesia, the criteria that were to be evaluated were:

1. Pain on needle insertion (POI)
2. Pain on deposition of solution (POD).
3. Grade of anesthesia (Dobb and Devier system). Grade of anesthesia was assessed according to the Dobb and Devier

System ⁽¹⁹⁾ which is Grade A anesthesia=Total analgesia on extraction, Grade B= Partial analgesia but with no reinjection required.

4. Postinjection complications (POC).

Pain on insertion and deposition was assessed according to a numerical value stated by the patient himself as followed:

- 0=No pain at all
- 1=Mild pain
- 2= Moderate pain
- 3= Severe pain

This evaluation is recommended by ⁽¹⁷⁾ putting in mind the variable pain response between each subject. Statistical test used was the (F) test. Comparisons were considered significant at $p \leq 0.05$.

RESULTS

The number of males and females who participated in the study is shown in

Table (1). The number and type of teeth extracted is shown in Table (2).

Table (1): Ratio of male to female.

Males	Females
77	23

Table (2): Number and type of teeth.

Tooth	Number
1 st premolar	47
2 nd premolar	25
1 st molar	28

For the 20 subjects who received the conventional dental block injection (control) the results were:

1. For pain on needle insertion and deposition, 65-75% of subjects stated that pain was mild taking in mind the variable pain response between different subjects.
2. The range of onset of anesthesia was between 1 and 2 minutes with a mean of 1.17 minutes (this was recorded

when lower lip anesthesia had begun). Surgical anesthesia ranged between 5-11 minutes with mean of 9 minutes.

3. For grade of anesthesia, a complete 100% of Grade A anesthesia was achieved provided that long buccal nerve and mental nerve anesthesia was performed. The above results are summarized in Table (3).

Table (3): Results of the conventional block technique

POI*	POD*	Onset*	SA*	Grade*
Pain Scale level (%)	Pain Scale level (%)	Range	Range	A
Nil= 5%-	Nil =30%	1-2min	5-11min	100%
1= 75%	1= 65%%	Mean	Mean	B
2=20%	2= 5%	1.17min	9 min	

POI= Pain on insertion of needle; POD= Pain on deposition of solution;SA=Surgical anesthesia

*Statistically significant

The Postinjection complications recorded on the second day following the nerve block technique were pain at the site of injection in 18 subjects and trismus in 11 subjects.

For the 80 subjects who received the P.D.L. injection, the results were as followed:

1. For pain on needle insertion and deposition, 69-86% of subjects stated that pain was moderate to severe taking in mind the variable pain response between different subjects.
2. The range of onset of anesthesia was between 10-50 seconds with a

mean of 20 seconds as assessed by probing the gingival tissue after the last injection. Surgical anesthesia ranged between 1.5-2.5 minutes with a mean of 2.1 minutes.

3. For grade of anesthesia achieved according to the Dobb and Devier system, 85% of injections achieved grade A anesthesia and 15% grade B anesthesia.

No.	%
Grade A	68 85
Grade B	12 15

The above results are summarized in Table (4).

Table (4): Results of the PDL injection

POI*	POD*	Onset*	SA*	Grade*
Pain Scale level (%)	Pain Scale level (%)	Range	Range	A
Nil= -	Nil = -	10-50 sec	1.5min	85%
1= 22.5%	1=12.5%	Mean	Mean	B
2=77.5%	2=68.7%	20sec	2.1 min	15%
	3=18.7%			

POI= Pain on insertion of needle; POD= Pain on deposition of solution; SA=Surgical anesthesia

*Statistically significant

- In regard to Postinjection complications, and as the injection was performed in the periodontal ligament where the tooth was extracted so possibly masking any Postinjection pain, none of the 80 subjects who received the P.D.L. injection reported any postoperative complications.

In regard to the statistical significances, the results were as followed:

- For pain on needle insertion and deposition, a significant difference ($p < 0.05$) between the two techniques was recorded favoring the inferior dental block over the P.D.L. injection in that the former technique is less painful.
- For onset of and achievement of surgical anesthesia, a significant difference ($p < 0.05$) between the two techniques was recorded favoring the P.D.L. injection over the conventional technique in that it is much faster in achieving complete anesthesia.
- For grade of anesthesia, a significant difference ($p < 0.05$) was recorded favoring the IDF technique (100%) over the P.D.L. injection (85%).
- Compare the above results in Tables (3 and 4).

DISCUSSION

The need for single tooth anesthesia in the mandible has led to the development of a number of techniques aimed for this goal one of which is the P.D.L. injection. The success rate of this injection according to adequate clinical anesthesia appears to be reliable as previous studies^(13,14,15) and showed 85% grade A anesthesia. Unlike the ligmajet syringe which does not require force on injection⁽¹⁾, the administrator using a conventional dental syringe has to apply considerable pressure to the thumb ring of syringe in order to force solution into the limited space of the P.D.L. In comparisons with the nerve block technique, the administrator finds it very easy to deposit the solution into the pterygo-mandibular space as it is wide enough to accept a volume of up to 2.2ml^(17, 18). This might explain the less pain experienced on insertion of needle and during the deposition of solution in the conventional technique when compared with the P.D.L. injection where the space is very limited for deposition of solution making it sometimes very painful. In previous studies^(13, 15), the results showed the opposite. In addition, this injection may cause tissue damage at the site of injection as reported in a previous study⁽²⁰⁾. An important concern to the operator was the possibility of the glass cartridge shattering when exposed to the pressure required to deposit 0.2ml of local anesthetic solution on each aspect of tooth to be anesthetized. Fortunately, no case of cartridge breakage or shattering took place. In regard to onset of and achievement of surgical anesthesia, the P.D.L. injection

appears to have an advantage over the conventional technique in that it is much faster (mean onset= 20 seconds (mean S.A.=2.1min) than the conventional block technique (mean onset =1.17 min) (mean S.A.= 9 min). This might be explained according to the fact that the solution is injected into the target area of work directly when using the P.D.L. injection making onset and achievement of adequate anesthesia faster. However, the majority of patients commented on the P.D.L. injection in that they felt no anesthesia of the lip nor tongue as most of them had a previous inferior dental block. This frankly made them psychologically uncomfortable. In addition, some of the solution leaked into the mouth. Putting in mind these two points, clinically adequate anesthesia was achieved in spite of the fact that neither lower lip nor tongue anesthesia was felt. This is a very important advantage in children who tend to chew on such anesthetized soft tissue ⁽¹⁾. In regard to its contraindications, this technique should not be used when there is acute infection at the site of injection and in children who have to extract primary teeth as this injection may damage the permanent tooth bud ^(9,21).

CONCLUSIONS

The P.D.L. injection appears to be a safe and effective way in providing adequate anesthesia of a single tooth although it is sometimes painful. This method can be used to achieve single tooth anesthesia as a single injection or as a supplementary one to either infiltration or nerve block techniques in either the maxilla or mandible. Further studies are recommended to further evaluate the success of the P.D.L. injection and the possible effect of this technique on the status of the P.D.L. and pulpal tissue.

REFERENCES

1. Malamed S. Handbook of Local Anesthesia. 4thed. C.V. Mosby Co, St Louis. 1997; p: 221.
2. Montagnese TA, Al Reader and Melfi R: A comparative study of the Gow-Gates technique and a standard technique for mandibular anesthesia *J Endo*, 1984; 10; 4.
3. Howe GL, Whitehead FIH. Local anesthesia in dentistry. 2^{ed}. Bristol, John Wright and Sons limited, 1981.
4. Gow-Gates GAE. Mandibular conduction anesthesia: a new technique using extraoral landmarks. *Oral Surg*, 1973; 36:321-320.
5. Watson JE, Gow-Gates GAE. A clinical evaluation of the Gow-Gates mandibular block technique. *NZ Dent J*, 1976; 72:220-223.
6. Robertson WD. Clinical evaluation of mandibular conduction anesthesia. *Gen Dent*, 1979; 27; 49-51.
7. Akinosi JO: A new approach to the mandibular nerve block. *Br J Oral Surg*. 1977; 15:83-85.
8. Jastak JT, Yagiela, Donaldson D. Local anesthesia of the oral cavity. WB Saunders Co. 1995.
9. Bennett R. Monheims local anesthesia and pain control in dental practise 5thed, CV Mosby Co, 1974.
10. Geffner I, Porteous JR. Haemorrhage and pain control in conservative dentistry for haemophilics. *Br Dent J*. 1981; 151:256-258.
11. Parnell AS. Danger to haemophilics of local anesthesia. *Brit Dent J*. 1969; 116:183-185.
12. Larson CE, Chang JL, Bleyaert AL, Bedger R. Anesthetic considerations for the oral surgery patients with hemophilia. *J Oral Surg* . 1982; 38:516-519.
13. Lilienthal B. A clinical appraisal of intraosseous dental anesthesia. *Oral Surg*. 1975; 39:692-695.
14. Malamed SF. The periodontal ligament (PDL) injection: An alternative to inferior alveolar nerve block. *Oral Surg*. 1982; 2:117-121.
15. Walton RE, Abott BJ. Periodontal ligament injection: A clinical evaluation. *JADA*. 1981; 103:571-573.
16. Repolge K, Reader A, Nist R, Beck M, Weaver J, Meyers WJ. Cardiovascular effect of intraosseous injections of 2% lidocaine with 1:100,000 epinephrine and 3% mepivacaine. *JADA*. 1999; 130:649-657.
17. Bell WE. Orofacial Pains. 4thed. Year Book Medical Publishers. Inc. 1989.
18. Gow-Gates GAE, Watson JE. Gow-Gates mandibular nerve block: Applied anatomy and histology. *AnesthProg*, 1989:193-195.

19. Dobbs EC, Devier C. L-Aterenol as a vasoconstrictor in local anesthetic. *JADA*.1950; 40:433-434.
20. Walton RE, Garnick JJ. The periodontal ligament injection: Histologic effects on the peridontium in monkeys. *J Endo*.1982; 1:22-26.
21. Brannstrom M, Lindskog S, Nordenvall JK. Enamel hypoplasia in permanent teeth induced by periodontal ligament anesthesia of primary teeth. *JADA*.1984; 109:735-736.