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Single Buccal Injection for Anesthesia of Upper First Molar

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ABSTRACT

Aims: A clinical trial was carried out to assess the efficiency of a single buccal injection to achieve anesthesia of the buccal aspect of the upper first molar instead of the traditional two injections. **Materials and Methods:** The subjects included in the clinical assessment were those needing extraction of an upper first molar of either side. For the purpose of comparison, the sample was randomly divided into two main groups: Group I (control group**)** which included 100 subjects who were to receive two buccal injections and a single palatal injection before extraction. While Group II (trial group) included 100 subjects who were to receive a single buccal injection and a single palatal injection before extraction. The following data were recorded: Pain on needle insertion, pain on deposition of solution, onset of surgical anesthesia and adequate surgical anesthesia. **Results:** The first criterion recorded was pain on needle insertion where the results showed no significant difference between both groups. The second criterion was pain on deposition of solution. Here the results also showed no significant difference between both groups in this aspect. For onset of surgical anesthesia, no significant difference was shown between both groups. In regard to pain grade experienced during surgery for both groups, the results showed that grade A anesthesia was recorded in 95% of patients in group I , whereas in 93% of patients in group II. Grade B anesthesia was recorded in 5% of patients in group I and in 7% of patients in group II. Statistically speaking, no significant difference was disclosed in regard to pain assessed during the extraction of the tooth between both groups. **Conclusions**: The achievement of successful local anesthesia is a continual challenge in dentistry. Any suggested new approach for achieving adequate anesthesia for either the maxilla or mandible as long as it is safe and effective can be recommended for routine dental care.

Key Words: Upper molar anesthesia, local anesthesia, anesthetic techniques.

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INTRODUCTION

The provision of many dental treatments depends upon achieving excellent local anesthesia. Pain-free operating is of obvious benefit to the patient, it also helps the operator as treatment can be performed in a calm, unhurried fashion [(1)]. A commonly used method for securing anesthesia of individual maxillary teeth and supporting periodontium in surgical as well as other dental procedures is the supraperiosteal injection commonly referred to as the infiltration technique, in which the anesthetic solution is placed adjacent to the periosteum of the alveolar bone overlying the apex of the tooth [(2,3)]. This technique is successful in up to 95% of cases as the maxilla is relatively porous and has a thin cortical plate of bone where the anesthetic solution is able to penetrate the bone and anesthetize terminal nerve fibers of the superior dental plexus (outer and inner loop) [(3)]. However, in the case of the upper first molar two separate buccal injections are required to achieve anesthesia of its two buccal roots. This is due to two important facts: The first is that there is a dense portion of bone formed by the zygomatic

buttress of maxillary bone overlying its two buccal roots that can preclude adequate penetration of the anesthetic solution [1,4-7]. The second fact is said to be that each buccal root receives a separate nerve supply, the mesiobuccal root by the middle superior alveolar nerve which is usually present in only 28% of population and if it is absent the mesiobuccal root is supplied by either the anterior superior alveolar nerve or less frequently by the posterior superior alveolar nerve [8], while the distobuccal and palatal roots are supplied by the posterior superior alveolar nerve [9,10,11]. The answer to this problem is to inject mesial and distal to the first molar away from the buttress where there is thin bone so that the local anesthetic solution will diffuse adequately to reach these two roots [1, 2]. Unfortunately, very little information is available in the literature suggesting the use of a single injection buccally to anesthetize the two buccal roots of such a tooth.

The purpose of this clinical evaluation was to assess the success of a single buccal injection for achieving anesthesia of the two buccal roots of the upper first molar at the same time.

MATERIALS AND METHODS

The clinical trial was conducted at the Department of Oral and Maxillofacial Surgery / College of Dentistry / Mosul University. The subjects included in the clinical assessment were those needing extraction of an upper first molar of either side after a final diagnosis has been reached indicating a non-restorable tooth or that root canal therapy or periapical surgery is not possible due to technical defects or large lesions which on surgery may jeopardize the maxillary sinus. The sample comprised of 200 subjects (130 males and 70 females) the age range was between 20-45 years with a mean of 28.3 years. The criteria for sample selection included those who were medically fit, had no previous history what so ever to any allergic reaction to the local anesthetic solution that was intended to be used and there were no evident clinical signs or symptoms of acute inflammation at the site of injection (cases of acute pulpitis were included in the trial). Each patient was informed of the purpose of this clinical trial before it was commenced.

The indications for the extraction of the upper first molar included:

1. Acute pulpitis in 21 patients.
2. Chronic pulpitis in 27 patients.
3. Chronic periapical lesion involving one or more roots in 131 of patients.
4. Failure of conventional root canal therapy in 12 patients.
5. Chronic periodontitis in 9 patients.

The sample was randomly divided into two main groups:

Group I (control group): Included 100 subjects who were to receive two buccal injections and a single palatal injection before extraction.

Group II (trial group): Included 100 subjects who were to receive a single buccal injection and a single palatal injection before extraction.

All principles of a correct injection technique such as good reflection, slow needle penetration, slow injection of solution.ect were carried out. For the control group, a total amount of 1.5ml solution was slowly given buccally on the mesial and distal aspects of the first molar roots while in the proposed approach the site of needle penetration was over the apex of the mesiobuccal root of the upper first molar and in a slight oblique angulation posteriorly to reach the area between the apices of the two roots where a total of 1.5ml of solution was slowly given. The purpose of this angulation was to gain sufficient depth of needle insertion as shown in the Figure. Onset of adequate surgical anesthesia was assessed by probing the gingival sulcus deeply on both sides buccally and palatally which at the same time separated the gingival tissues from the tooth. This was accurately recorded as much as possible in minutes and seconds. For the purpose of standardization, a time of 5 minutes had to elapse before extraction was performed. In addition, all the injections but not necessarily all extractions were performed by a single operator to avoid operator mediated errors. The use of a spray local anesthetic before injection was excluded to avoid any masking of pain sensation on needle insertion and deposition of local anesthetic solution.

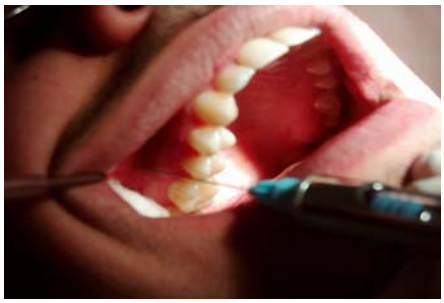

Figure: single buccal injection

The following data were recorded; pain on needle insertion, pain on deposition of solution, onset of surgical anesthesia, adequate surgical anesthesia.

Pain on needle insertion as well as deposition of solution was assessed using Verbal Description Scales of Pain by asking the patient to what he/she would reply and as either 0=no pain at all, 1= mild pain, 2= moderate, or 3= severe pain [12].

The onset of surgical anesthesia and as stated before was assessed by probing the gingiva overlying the tooth that was to be extracted using a sharp dental probe until total abolition of pain sensation as stated by the patient.

Adequate surgical anesthesia necessary to perform a painless extraction was evaluated according to the Dobb and Devier System [13] which is as follows:

Grade A anesthesia: No pain completely on extraction.

Grade B anesthesia: Mild to moderate tolerable pain.

Grade C anesthesia: Severe un-tolerable pain with additional anesthesia given. In such case the patient was to be excluded from the clinical evaluation.

The statistical analysis was performed utilizing Students t–test to determine the significance of difference in regard to onset time of action of anesthesia between the control and study group. The Chi–square test was used to determine the significance of difference of pain recorded during needle insertion, injection and during extraction between both groups at $p < 0.05$.

RESULTS

In regard to pain on needle insertion as shown in Table (1), the control group showed 82% of subjects who felt mild pain and 18% who felt moderate pain. Whereas in the trial group 87% of patients felt mild pain while 13% of them felt moderate pain. No significant difference was shown between both groups (x^2=0.954, df=1, p= 0.329).

Table (1): Percentage of pain on needle insertion

Grade of pain on needle insertion	Group I No. (%)	Group II No. (%)
No pain	0 (0%)	0 (0%)
Mild pain	82 (82%)	87 (87%)
Moderate pain	18 (18%)	13 (13%)
Severe pain	0 (0%)	0 (0%)
Total number	100	100

x 2 = 0.954, df =1, p =0.329.

The second criterion that was evaluated was pain on deposition of solution. Here the results showed that in the control group 82% of subjects experienced mild pain and 18% of them felt moderate pain sensation. In the trial group, 88% of subjects felt mild pain and 12% of them experienced moderate pain. No significant difference was disclosed between both groups (x^2= 1.412, df = 1, p = 0.235) as shown in Table (2).

For onset of surgical anesthesia recorded in both groups, a highly significant difference was disclosed with a more rapid onset of action in the control group with a mean onset of action of 2.71 min. when compared with the trial group where the mean onset of action was 3.77 min. as shown in Table (3).

Table (2): Percentage of pain on deposition of solution

Grade of pain on deposition of solution	Group I No. (%)8	Group II No. (%)
No pain	0(0%)	0(0%)
Mild pain	82 (82%)	88 (88%)
Moderate pain	18 (18%)	12 (12%)
Severe pain	0(0%)	0(0%)
Total number	100	100

x^2 =1.412 , d.f=1, *p*=0.235

Table (3): Onset of surgical anesthesia

Group	No.	Mean (min.sec)	SD	t - Value	p
I (Control)	100	2.71	0.55	- 13.15	0.000 (H.S.)
II (Trial)	100	3.77	0.58		

d.f = 198

Table (4) represents pain grade experienced during surgery for both groups, the results were as follows:

Grade A: Pain score was recorded in 95% of patients in the control group, whereas in 93% of patients in the trial group.

Grade B: This pain score was recorded in 5% of patients in the control group, whereas in 7% of patients in the trial group.

Grade C: This pain score was fortunately not recorded in either group.

Statistically speaking, no significant difference was disclosed in regard to pain assessed during the extraction of the tooth between both groups (x^2=0.355, df =1, *p*=0.552).

Table (4): Pain grade scale on extraction of tooth

Grade of pain during extraction	Group I : No. (%)	Group II : No. (%)
Grade A	95 (95%)	93 (93%)
Grade B	5 (5%)	7 (7%)
Grade C	0 (0%)	0 (0%)
Total number	100	100

x^2 =0.355, d.f=1, *p* = 0.552

DISCUSSION

Unfortunately, to our knowledge very little literature was available to compare with the results of the current clinical trial. All resources available recommend that for achieving anesthesia of the buccal aspect of the upper first molar, two separate injections are necessary. The results of the current clinical evaluation showed a 93% success rate in regard to achieving Grade A surgical anesthesia using a single buccal injection between the two buccal roots of the upper first molar. In a dissection study by Loetscher and Walton [8], the middle superior alveolar nerve provided sensory innervation to the mesiobuccal root of the maxillary first molar in 28% of the specimens examined and concluded that the posterior superior alveolar nerve provides sole pulpal innervation to the maxillary first molar, hence a single injection may be justified. In addition, an adequate volume of anesthetic solution injected (as a general rule, in adult patients about 1.0 ml

of solution should be deposited for infiltration injections in the maxilla) [4] as well as the thin and porous nature of the maxillary bone (which facilitates diffusion) will indeed play an important role in the success of a single buccal injection [1]. In this clinical trial, a total amount of 1.5 ml of local anesthetic solution was injected buccally. However, a single buccal injection to achieve anesthesia of the upper first molar may not be as effective in old subjects due to the obvious bone density over its roots, but of course a single injection is less painful than two injections adding another advantage to this proposed approach.

CONCLUSIONS

The achievement of successful local anesthesia is a continual challenge in dentistry. Any suggested new approach for achieving adequate anesthesia for either maxillary or mandibular teeth can be recommended for routine dental care as long as it is safe and effective.

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