Acta Odontologica Scandinavica, 2013; 71: 740–743

informa
healthcare

ORIGINAL ARTICLE

Comparison of the pain levels of computer controlled and conventional anesthesia techniques in supraperiosteal injections: A randomized controlled clinical trial

SMITA SINGH & ANIKET GARG

Department of Conservative Dentistry and Endodontics, Darshan Dental College and Hospital, Loyara, Udaipur, Rajasthan, India

Abstract

Aim. To compare the pain perception using a traditional Syringe vs Computer controlled 'Anaeject' device in supra periosteal injections. ***Methodology.*** One hundred volunteers were selected on a random basis for the study and were explained about the goals of study and signed the consent form. They served as their own controls, i.e. in the same subject both the computer controlled 'Anaeject' device and traditional syringe were used on the contralateral sides for obtaining anesthesia. Pain levels were recorded during needle prick and anesthetic delivery. Post-operative pain at the site of injection 5 h after the anesthesia was also recorded. Heft Parker visual analog scale (VAS) was used to evaluate pain levels. ***Results.*** Final analysis was done on 90 subjects. Subjects reported significantly lower pain ratings at the time of needle prick and the delivery of local anesthetic using a computer-controlled 'Anaeject' device as compared to traditional syringes. Pain at the site of injection 5 h post-operative was also low in the computerized anesthesia group but it was not statistically significant. ***Conclusion.*** In this *in vivo* study it was found that subjects perception of pain was significantly low for supraperiosteal injections while using computerized anesthesia as compared to that of conventional disposable syringes.

Key Words: *computerized anesthesia, conventional syringes, pain, visual analog scale*

Introduction

Local anesthesia and pain control is one of the most important elements of dentistry. According to the American Dental Association, fear of pain is the most important factor preventing subjects from visiting their dentists. Different kinds of fear related to previous clinical experience affect subjects' attitudes to local anesthesia or dentist.

Incidents of discomfort or pain associated with local anesthesia may result in far greater and protracted problems than loss of time, efficiency or confidence with one appointment. A study reports that 20–23% of the population is highly anxious or even phobic about dental treatment [1]. When interviewed, most individuals recount an episode or preconception of painful dental treatment associated with the injection or identify the needle or syringe as the predominant fear provoking stimuli [2]. Many of these affected individuals, as a consequence of these fears, delay or avoid dental treatment or else they endure subsequent treatment with great physical and psychological distress.

A variety of measures and devices have been suggested or employed in order to ensure the success or comfort of the needle injection or even to provide an alternative to it. The use of sedative-hypnotic and relaxing drugs such as nitrous oxide, barbiturates and tranquilizers is well documented and well accepted [3,4]. Nowadays the most commonly used anesthetic agents in various dental treatments include Lignocaine, Articaine, Bupivacaine, Mepivacaine, Prilocaine, etc. [4]. Recent anesthetic devices of interest include electronic devices for transcutaneous electronic nerve stimulation [5] (DEA: 3M Dental Products, St. Paul, MN), needleless injection systems [4] (Madajet: Mada Equipment Co., Caristadt, NJ), intraosseous injection systems [6] (Stabident: Fairfax Dent Inc,

Correspondence: Dr Smita Singh, Department of Conservative Dentistry and Endodontics, Darshan Dental College, Udaipur, Rajasthan, India. Tel: +919829234031. Fax: +0294 2444031. E-mail: garg.aniket@hotmail.com

(Received 30 March 2012; accepted 14 May 2012)

ISSN 0001-6357 print/ISSN 1502-3850 online
DOI: 10.3109/00016357.2012.715200

Miami, FL) and a cutaneous deliver bioadhesive patch (DentiPatch: Noven Pharmaceuticals, Lincoln Park, NJ).

In a study conducted by Yenisey [7] to compare the pain levels of computer controlled and conventional anesthesia techniques in prosthodontics treatment it was concluded that the Wand technique reduces the pain levels during needle insertion and delivery of local anesthesia, however both the techniques result in the same pain levels for tooth preparation.

A recently introduced anesthetic delivery device, the anaeject (Septodont), offers numerous advantages and safeguards over the standard manual syringe delivery system. The anaeject is a computer controlled cordless anesthetic delivery device that delivers a constant flow rate of local anesthetic regardless of the location, density and resiliency of the soft tissues at the injection site. In anaeject, injection is initiated by contact of two sensors, thereby minimizing the unsteadiness that results in painful insertions. Also this device allows the needle to be sensed in the same way as when using a manual conventional syringe.

Materials and methods

Subjects and subjects

The study and informed consent forms were approved by Darshan Dental College and Hospital committee on human research. One hundred subjects were selected randomly for the study. They ranged in age from 20–65 years. They were in good health and were not taking any medication that would alter their pain perception. Subjects who had allergy to lidocaine, a history of significant medical problems, pregnancy, inability to give informed consent and the subjects on central nervous system depressants within 48 h of root canal treatment, were excluded from the study. Subjects were informed about the study and consent was obtained for the same. None of the subjects had previous experience of any dental treatment.

Procedure of anesthesia

Subjects served as their own controls. The supra periosteal technique with the anaeject for the maxillary canine in one arch and conventional disposable syringe for the same tooth in opposite maxillary arch were administered by the same operator. Same tooth, i.e. maxillary canine, was selected for supraperiosteal injections in all subjects to minimize the chances of error. The order of anesthesia techniques was randomly selected. The subjects were blindfolded with a commonly used sleeping mask so that they would not distinguish which anesthetic delivery system was used. At the time of checking for allergy of the drug A or T was marked on the subjects arm in the order of technique used. For, e.g. if by coin test it was decided that Anaeject method will be used first then the patient was asked about his or her side of preference for the treatment and if the subjects said left side then the patient was checked for allergy on the left side arm and the word A was written on the left side arm, which means the Anaeject technique was used on the left side tooth. Immediately after needle insertion and the delivery of local anesthetic, subjects were asked to remove the mask and rate the pain. No topical anesthetic was used in either of the techniques. In both the techniques only local infiltrations (supra periosteal injections) were administered. The amount of local anesthetic solution injected was constant, i.e. 0.6 ml. The local anesthetic used was also the same for both the techniques, i.e. lignocaine HCL with 1:80 000 adrenaline. The area of insertion of the needle was at the height of the mucobuccal fold above the apex of the tooth being anesthetized. Orientation of the bevel was kept towards the bone. The needle was advanced until its bevel was at the apical region of the tooth; negative aspiration was ensured followed by deposition of 0.6 ml of local anesthetic agent. No palatal infiltration was given. Post-operative pain at the site of injection was again recorded after 5 h. The anesthetic injection on the other side was given only after 24 h of first injection. The subjects were already informed that they will have one more appointment on the next day. The melody which anaeject plays during anesthetic delivery was turned off so that the subjects may not know which technique was being used. The size of the needle used with the conventional method of anesthesia was the same for all the subjects. Values thus obtained were submitted for statistical analysis.

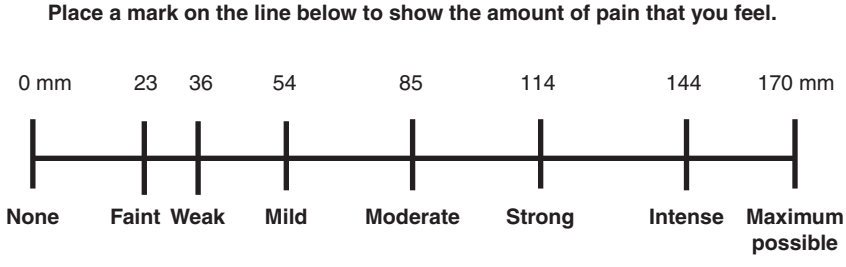

Figure 1. Heft Parker visual analog scale.

Pain measurement

Heft Parker visual analog scale was explained to the subjects before injection. Subjects were instructed to place a mark on the horizontal scale to represent the intensity of pain experience; furthermore, they were asked to use the verbal descriptors as a guide. Subjects were asked to score the pain experienced during prick and administration of local anesthetic in front of the operator. This helped them in understanding the VAS better so that they can correctly score the 5-h post-operative pain at the site of injection when contacted through phone calls.

Results

A total of 100 subjects (60 male and 40 female) aged from 20–65 years participated in this study. Ten patients were excluded as they failed to report for the second appointment. So the final analysis was done on 90 patients (54 males and 36 females). The mean scores for pain during needle prick for the conventional and computerized anesthesia group were 19 ± 8.2 SD and 11.03 ± 7.26 SD, while the mean scores for anesthetic delivery phase were 22.9 ± 10.68 SD and 13.17 ± 9.20 SD, respectively. Results of the Mann-Whitney test for anesthetic injection pain ratings and post-injection pain ratings are summarized in Tables I and II. Subjects registered significantly lower pain ratings in the computerized anesthesia, i.e. Anaeject, technique during needle prick and local anesthetic delivery phase as compared to the traditional syringes. Pain at the site of injection 5-h after the treatment was also low in the computerized anesthesia method, but it was not statistically significant.

Table I. The data obtained from VAS form was analyzed using Mann-Whitney test: Ranks.

Method	*n*	Mean rank	Sum of ranks
C^{ins}	90	38.22	3439.90
A^{ins}	90	22.78	2050.20
Total	180		
C^{ad}	90	38.62	3475.80
A^{ad}	90	22.38	2014.20
Total	180		
$C^{post\text{-}op}$	90	32.93	2963.70
$A^{post\text{-}op}$	90	28.07	2562.30
Total	180		

C^{ins}, pain during needle prick with conventional syringe; C^{ad}, pain during administration of local anesthetic with conventional syringe; $C^{post\text{-}op}$, pain 5-h after administration of local anesthetic with conventional syringe; A^{ins}, pain during needle prick with anaeject; A^{ad}, pain during administration of local anesthetic with anaeject; $A^{post\text{-}op}$, pain 5-h after administration of local anesthetic with anaeject.

Discussion

The majority of the literature on the computer-controlled injection system (the Wand) has dealt with the pain of injection with the computer-assisted injection system, compared to injection using a conventional syringe [8–10]. In general, the results have been favorable [9,11] for the computer-assisted injection system, with only two studies showing no difference [12,13] and one study showing higher pain ratings [14] with the computer-assisted injection system.

The pain perceived during administration of local anesthetics is a two-part phenomenon. The first sensation is caused by the needle puncture, which causes a short, intense pain. The second pain involves activation of nociceptors responding to both the chemicals in the infiltrated agent and rapid distention of the tissue. The second sensation is both more intense and more prolonged [15].

Friedman and Hochman [8] stated that careful needle insertion and slow anesthetic delivery could reduce the sensation of needle insertion.

Primosch and Brooks [10] concluded that slow anesthetic delivery produces significantly lower pain scores than fast anesthetic delivery. The computer controlled local anesthetic delivery systems deliver local anesthetic slowly. Speed of injection is related to injection discomfort; the faster the injection the greater the discomfort. As computerized systems deliver the solution slowly, it would be anticipated that they provide comfortable injections.

Anaeject has three injection speeds, i.e. high = 0.016 ml/s, medium = 0.011 ml/s and low = 0.005 ml/s. It also has auto and constant speed modes to regulate the speed of injection. In this study auto mode at medium injection speed was selected. When auto mode is selected, injection speed is gradually increased until it reaches the selected speed, i.e. low, medium or high. When constant mode is selected injection speed remains constant from start to finish, which is good for additional administration.

The anaeject offers several advantages over traditional syringes, including the slow and controlled rate of anesthetic flow and also the melody which it plays during anesthetic delivery, which further reduces patient discomfort and anxiety.

Many factors such as anxiety, fear, trust, perceived control over painful stimulus, interpretation of the painful stimulation and personality influence pain but, because in this study both the techniques were used on the same patient, i.e. subjects served as their own control, chances of error were minimized. Also, the subjects selected for the study were taken from the regular subjects visiting the endodontic center of Darshan Dental College to simulate the clinical conditions rather than conducting the study on experimental subjects who do not need any dental treatment.

Table II. Test statistics.

	Pain during needle insertion	Pain during administration of local anesthesia	Post-operative pain at the site of injection
Mann-Whitney U	218.500	206.500	377.000
Wilcoxon W	683.500	671.500	842.000
Z	−3.426	−3.609	−1.091
Asymp. Sig. (2-tailed)	0.001	0.000	0.275
Statistical results	Significant	Significant	Non-significant

The pain evaluation was done with a Heft-Parker visual analog scale. This is a bounded scale with values of 0 at one end and 170 at the other end. Heft-Parker states that the unequal spacing of words on the scale represents an accurate reflection of how subjects perceive spacing between the different pain word descriptors [16]. When properly designed and administered, a VAS is considered to be a valid and reliable ratio scale instrument for the measurement of human pain intensity and unpleasantness [17].

Conclusion

Under the limitations of this study it is concluded that the anaeject technique for supra periosteal injections reduces pain level significantly both during needle insertion and delivery of the anesthetic solution as compared to the traditional syringes.

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

References

[1] Locker D, Shapiro D, Liddell A. Who is dentally anxious: concordance between measures of dental anxiety. Community Dent Oral Epidemiol 1996;24:346–50.
[2] Rao A, Sequeire PS, Peter S. Characteristics of dental fear amongst dental and medical students. Indian J Dent Res 1997;8:111–14.
[3] Holroyd SV, Wynn RL, Requa-Clark B. editors. Clinical pharmacology in dental practice. 4th ed. St Louis, MO: Mosby; 1998.
[4] Malamed SF. Handbook of local anesthesia. 4th ed. St Louis, MO: Mosby; .
[5] Meechan JG, Gowans AJ, Welbury RR. The use of patient-controlled transcutaneous electronic nerve stimulation (TENS) to decrease the discomfort of regional anaesthesia in dentistry: a randomised controlled clinical trial. J Dent 1998;26:417–20.
[6] Leonard MS. The efficacy of an intraosseous injection system of delivering local anesthetic. J Am Dent Assoc 1995;126:81–6.
[7] Yenisey M. Comparison of the pain levels of computer controlled and conventional anesthesia techniques in prosthodontic treatment. J Appl Oral Sci 2009;17:414–20.
[8] Friedman M, Hochman M. A 21st century computerized injection system for local pain control. Compendium 1997; 18:995–1003.
[9] Hochman M, Chiarello D, Bozzi-Hochman C, Lopatkin R, Pergola S. Computerized local anesthetic delivery vs. traditional syringe technique. N Y State Dent J 1997;63: 24–9.
[10] Primosch RE, Brooks R. Influence of anesthetic flow rate delivered by the Wand local anesthetic system on pain response to palatal injections. Am J Dent 2002;15: 15–20.
[11] Allen KD, Kotil D, Larzelere RE, Hutfless S, Beiraghi S. Comparison of a computerized anesthesia device with a traditional syringe in preschool children. Pediatr Dent 2002;24: 315–20.
[12] Asarch T, Allen K, Petersen B, Beiraghi S. Efficacy of a computerized local anesthesia device in pediatric dentistry. Pediatr Dent 1999;21:421–4.
[13] Saloum FS, Baumgartner JC, Marshall G, Tinkle J. A clinical comparison of pain perception to the Wand and a traditional syringe. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2000;89:691–5.
[14] Goodell GG, Gallagher FJ, Nicoll BK. Comparison of a controlled injection pressure system with a conventional technique. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2000;90:88–94.
[15] Zilinsky I, et al. Ten commandments for minimal pain during administration of local anesthestics. J Drugs Dermatol 2005;4: 212–18.
[16] Heft MW, Parker SR. An experimental basis for revising the graphic rating scale for pain. Pain 1984;19:153–61.
[17] Price DD, McGrath PA, Rafi A, Bukingham B. The validation of visual analogue scales as ratio scale measures for chronic and experimental pain. Pain 1983;17:45–56.

Supplementary material available online

Appendix