IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 20, Issue 8 Ser.8 (August. 2021), PP 11-16
www.iosrjournals.org

Comparative Evaluation of Pain Perception in Delivery of Local Anesthesia by Conventional Method and C Clad System in Periodontal Surgical Procedures

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Abstract
Aims: *The aim of this study was to compare pain perception of needle insertion and nerve block during delivery of local anesthesia with c clad system and conventional syringe in periodontal surgeries.*
Settings and Design: *clinical study*
Methods and Material: *Thirty patients between the ages of 20 and 45 years requiring local anesthesia for periodontal surgeries were randomly allocated to receive local anesthesia with the CCLAD system (Comfort Control Syringe) and the Conventional syringe (Aspirating Syringe). Lidocaine 2 % with adrenaline (1:80,000) was given as an nerve block. The pain experience during the Local Anesthesia was recorded using a visual analogue score (VAS) & wong-baker faces pain rating scale.*
Statistical Analysis Used: *One Way ANOVA test, Kruskal Wallis test, Unpaired t-test, VAS(visual analouge scale), FRS(wong-baker faces pain rating scale).*
Results: *Local anesthetic solution administered with a C CLAD system reduces pain level significantly when compared to the conventional syringes.*
Conclusions: *Under limitations of this study it is concluded that the anesthetic solution administered with a CCS reduces pain level significantly when compared to the conventional syringes,and needle diameter also have influence on pain reduction i;e smaller the diameter lesser will be the pain during needle insertion.*
Key-words: *CCS, Conventional syringe, Pain perception, Visual analogue score, wong-baker faces pain rating scale.*
Key-message: *CCS provides less painful injections then conventional injection technique.*

Date of Submission: 06-08-2021 Date of Acceptance: 19-08-2021

I. Introduction

Many dental patients are fearful about receiving intraoral injections of local anesthetic. In fact, many patients cite injections as their primary reason for avoiding dental treatment. In late 1997, however, a computerized local anesthetic delivery system was introduced to addressthe problems of pain and anxiety associated with these injections[1]. Hence, this study was to compare pain perception during delivery of local anesthesia and needle insertion using Midwest® comfort control syringe (CCS)™ and the conventional injection technique during periodontal surgical procedures.

II. Materials And Methods

This study was conducted in the Department of Periodontology & oral implantology in K.D Dental college & Hospital, Mathura, and institutional ethical clearance was obtained. The patients were explained about the procedure, and informed consent was obtained. Patients aged between 20 and 45 years in good health undergoing periodontal major / minor surgeries in mandibular and maxillary region were included. CCS (Midwest-Densply-Canada) (Figure 1 A): is an electronic pre-programmed computerized local anesthetic injection device.

Figure 1 A

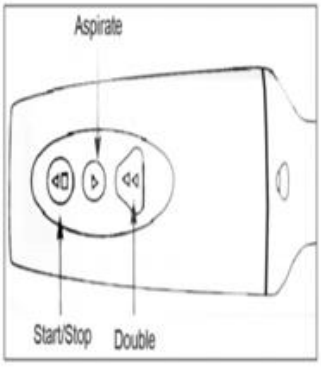
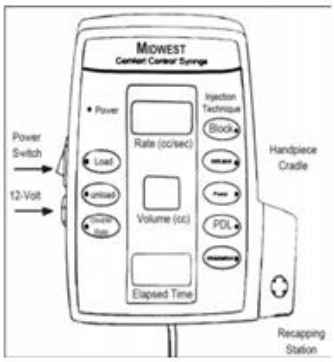


Figure 1 B



Fugure 1 C

The CCS comprises a main control unit, a syringe- and- needle hand- piece, ultra tubing connecting the control unit to the syringe- and- needle hand piece.
The injection speed of the device could be adjusted to two levels: Fast or slow.
The hand piece has three buttons (a) start or stop button (b) aspirate button (c) double button (Figure 1 B). The display of device shows the rate of injection, time elapsed during the injection, and the cumulative volume injected(Figure 1 C).
The anesthetic cartridge (Lignospan special – Septodent – France) consisting of 2% Lidocaine with 1:80,000 adrenaline loaded into the cartridge sheath and then the sheath is inserted into the hand piece. A standard dental needle of 30 gauge was selected and screwed into the cartridge[1].

Inclusion criteria

All the included patients had been clinically indicated with (1) No history of systemic disease that could affect the outcome of periodontal therapy, (2) patients suffering from periodontal problems and indicated for periodontal surgeries (minor & major),(3) no history of smoking.

Exclusion criteria

Patients excluded from the study were (1) pregnant patients, (2) use of any medication known to influence local anesthetic agent, (3)Patient with severe needle phobia, taking any medication that would alter pain perception, were excluded.
C CLAD system using different gauze of needle of 30 gauge,27 gauge which were compared with standard size 25 gauge in terms of pain during injection.
The patients were randomly divided into three groups of Ten each:
Group 1 Computer-controlled injection system (Comfort Control Syringe, MIDWEST, DENTSPLY) (Figure:2A): nerve block of lidocaine hydrochloride 2% with adrenaline 1:80,000, marketed in special cartridge, using compatible disposable 30-gauge, 10 mm needles and auto-controlled injection system.
Group II Computer-controlled injection system (Comfort Control Syringe, MIDWEST, DENTSPLY) (Figure:2B): nerve block of lidocaine hydrochloride 2% with adrenaline 1:80,000 (Figure:2C : lignospan special), marketed in special cartridge, using compatible disposable 27-gauge, 10 mm needles and auto-controlled injection system.
Group III Conventional syringe (Aspirating Syringe) (Figure:2D) : nerve block of 2% lidocaine hydrochloride with adrenaline 1:80,000, using 25-gauge, 10 mm needle and disposable TS.

Figure 2A

Figure 2B

Figure 2C

Figure 2D

The anesthetic solution in all patients was delivered by same operator, to ensure that the results were not influenced by interoperator variability. Pain perception rating was obtained by using 10 point visual analog scale (VAS) of pain rating (Figure:3A); wong-baker faces pain rating scale (Figure:3B)

The left side was marked "no pain" and the right side marked "worst pain imaginable". A 10 point verbal rating was also used and patients were asked to give a value to their pain experience, zero being "no pain". Values thus obtained were submitted for statistical analysis[2].

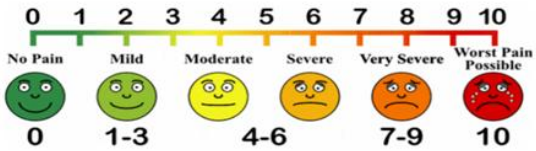


Figure 3A

Figutre 3B

III. Injection By The Computerized Device

The local anesthesia was administered using computerized device on one side of the arch. Prior to the procedure the heart rate and oxygen saturation level were measured using pulse oximeter (vaku luxos fingertip pulse oximeter,vaku luxos,zibbri india pvt.Ltd.) and temperature was recorded using digital thermometer(K-Life KLT -100 thermameter ,shri jai ambey inc.India).Blood pressure were recorded using digital blood pressure monitor machine(sahyog wellness,india.) For the CCS the procedure was followed as specified by the manufacturer.

Pre-programmed injection type was selected on the control unit and during the administration of local anesthesia; the heart rate and blood pressure were also recorded. Immediately after the injection the patient's pain perception was assessed by the VAS and wong – baker faces pain rating scale . After assessing the pain by self-report measures, the heart rate, blood pressure and the temperature were finally recorded.

IV. Injection By The Conventional Syringe

During next procedure traditional syringe was used. The heart rate and blood pressure and the temperature were recorded prior to the administration of local anesthesia. Local anesthesia was delivered using conventional syringe and during administration the heart rate and blood pressure of the patient were recorded. Immediately after the injection the patient's pain perception was assessed by the VAS and Wong –baker faces pain rating scale. After assessing the pain by self-report measures, the heart rate, oxygen saturation level, blood pressure and the temperature were finally recorded.

V. Results

Table1 is showing mean and Standard deviation (SD) using one way anova test using different gauge of needle with Comfort Control Syringe and conventional syringe group. Mean VAS score used for assessment of pain perception during Comfort Control Syringe group I (30 gauge) =(1.00± 0.67) & (group II 27 gauge)=(3.70 ± 0.48) was found to be significantly lower than that found in Conventional Syringe group III(25gauge) (5.40 ± 0.84).

One way anova (Table:1)

Variable	Time	N	Mean	S.D.	F	P-value	Inferences
VAS SCORE (NEEDLE SIZE)	GROUP I(30 gauge)	10	1.00	0.67	106.344	0.000	S
	GROUP II(27 gauge)	10	3.70	0.48			
	GROUP III(25 gauge)	10	5.40	0.84			

Table 2 is showing mean VAS score and Standard deviation (SD) using kruskal wallis test with Comfort Control Syringe and conventional syringe group.
Mean VAS score used for assessment of pain perception during Comfort Control Syringe group I(1.11± 0.93) group II (3.22 ± 0.97) was found to be significantly lower than that found in Conventional Syringe group (5.22 ± 0.67).

Kruskal Wallis Test (Table:2)

Variable	Time	N	Mean	S.D.	Median	Chi-Square	P-value	Inferences
VAS	Group I	9	1.11	0.93	1.00	21.602	0.000	S
	Group II	9	3.22	0.97	4.00			
	Group III	9	5.22	0.67	5.00			
FRS	Group I	9	1.56	1.33	2.00	21.231	0.000	S
	Group II	9	3.33	1.00	4.00			
	Group III	9	6.44	0.88	6.00			

Table 2 is showing mean VAS score and Standard deviation (SD) using kruskal wallis test with Comfort Control Syringe and conventional syringe group.
Mean VAS score used for assessment of pain perception during Comfort Control Syringe group I(1.11± 0.93) group II (3.22 ± 0.97) was found to be significantly lower than that found in Conventional Syringe group (5.22 ± 0.67).
Table 2 is showing mean FRS score and Standard deviation (SD) using kruskal wallis test with Comfort Control Syringe and conventional syringe group. Mean FRS score used for assessment of pain perception during Comfort Control Syringe group I =(1.56± 1.33) group II =(3.33 ± 1.00) was found to be significantly lower than that found in Conventional Syringe group (6.44 ± 0.88)

Tables 3 shows the value of the mean blood pressure and heart rate in conventional injection technique at various interval of time respectively. No significant differences in the physiological parameters were observed.

Table:3 One way Anova Test(conventional technique)

Variable	Time	N	Mean	S.D.	F	P-value	Inferences
Systolic B.P.	Before	10	112.72	1.61	4.453	0.021	S
	During	10	114.33	1.78			
	After	10	114.91	1.71			
Diastolic B.P.	Before	10	75.38	2.27	1.873	0.173	NS
	During	10	76.91	1.93			
	After	10	76.95	1.99			
Heart rate	Before	10	98.71	1.99	1.644	0.212	NS
	During	10	99.65	1.63			
	After	10	100.06	1.45			

Tables 4 shows the value of the mean temperature and oxygen saturation level in conventional injection technique at various interval of time respectively. No significant differences in the physiological parameters were observed.

Table: 4 Independent t test ,Temperature & oxygen saturation level(conventional

Variable	Time	N	Mean	S.D.	T-test	P-Value	Inferences
Temperature	Before	10	97.97	0.50	1.027	0.318	NS
	After	10	98.19	0.46			
Oxygen level	Before	10	97.67	0.11	0.828	0.418	NS
	After	10	97.71	0.11			

Tables 5 shows the value of the mean blood pressure and heart rate level in comfort control syringe injection technique at various interval of time respectively. No significant differences in the physiological parameters were observed.

Table: 5 One way anova test (computerized technique)

Variable	Time	N	Mean	S.D.	F	P-value	Inferences
Systolic B.P.	Before	10	114.10	2.26	2.136	0.138	NS
	During	10	115.44	1.91			
	After	10	115.88	1.82			
Diastolic B.P.	Before	10	75.95	1.85	1.391	0.266	NS
	During	10	77.07	1.55			
	After	10	76.94	1.50			
Heart rate	Before	10	98.14	1.03	4.031	0.029	S
	During	10	99.19	0.96			
	After	10	99.27	0.99			

Tables 6 show the value of the mean temperature and oxygen saturation level in computerized injection technique at various interval of time respectively. No significant differences in the physiological parameters were observed.

Table: 6 Independent t-test,Temperature & oxygen saturation level (computerized technique)

Variable	Time	N	Mean	S.D.	T-test	P-Value	Inferences
Temperature	Before	10	97.91	0.47	0.833	0.416	NS
	After	10	98.09	0.49			
Oxygen level	Before	10	97.54	0.15	0.000	1.000	NS
	After	10	97.54	0.14			

VI. Discussion

The most common reason for patients not to visit the dentist is dental fear. Dental fear can occur for a variety of reasons, including noise and vibration from tooth cutting devices such as pain during dental treatment and local anesthesia's irrational fear. Patients, however, often fear pain caused by anesthetic injections rather than pain caused by dental treatment[3].

A number of devices have been introduced that can inject local anesthetics into the tissues at a set speed. These "painless anesthetic devices" are collectively referred to as computer controlled local anesthetic delivery devices (CCLAD). Currently, the Wand system, Quicksleeper and Comfort Control Syringe are available for this type of device[4].

In this study, a computer-controlled local anesthetic delivery system for nerve block injection with 27 and 30 gauge needle size before periodontal surgeries led to a lower mean pain perception level for a group of 10 patients each respectively compared to a traditional syringe injected group III with 25 gauge needle size.

This could be because local anesthetic supply systems controlled by the computer deliver local anesthesia at a slowly graduated speed controlled by the equipment. Injection speed is associated with injection discomfort; the faster LA is delivered, the more discomfort is caused. Since computer systems provide the solution slowly, they are expected to provide a comfortable injection process. Some authors say that using the WAND reduced anxiety about dental injection in most patients[5].

Lipp and others[6] suggested that basic information before dental anesthesia could be a useful method to reduce anxiety and improve the confidence of a patient in a dentist or surgeon. Lackey and others concluded that WAND was a viable alternative to traditional local anesthetic administration and reduced fear and anxiety in dental patients with this system. The CCLAD system overcomes the human error when compared to the conventional Local Anesthesia delivery system in terms of controlling the speed of anesthetic delivery in the tissues.

Another study, Dulger and others found a highly significant statistical difference between the VAS values recorded for the two groups with the computer-controlled injected group, with a mean VAS value of 1.08 compared to 2.58 for the traditional syringe injected group[7].

In their comparative clinical study of 50 patients, Hochman and others reported that the WAND was 2 to 3 times less painful than traditional syringe injection and that 48 of 50 patients had a more comfortable WAND injection. They concluded that there was an optimal anesthetic flow rate that minimizes the perception of pain during an injection[8].

In a study carried out by Yenisey to compare pain levels of computer controlled and conventional anesthesia techniques in the treatment of prosthodontics, it was concluded that the Wand technique reduces pain levels during needle insertion and local anesthesia[9].

Goodell and others instead found that the use of a conventional syringe injection technique was superior to the WAND. This study reported reduced pain perception, increased tolerance and reduced dental anxiety after injection when using conventional syringe. It should be noted that this study included predominantly men employed in the military service and that a more randomly selected group could expect different results[10].

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Gaurav Singh, et. al. "Comparative Evaluation of Pain Perception in Delivery of Local Anesthesia by Conventional Method and C Clad System in Periodontal Surgical Procedures." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 20(08), 2021, pp. 11-16.