Effectiveness of Computerized Delivery System of Local Anesthesia in Primary Maxillary Molars Regarding Pain and Fear during Vital Pulpotomy Procedure

Thesis

Submitted to the Faculty of Dentistry, Ain Shams University for partial Fulfillment of the Requirement of the Master's Degree in Pediatric Dentistry

By

Reem Wadi Hnshal Aljumaili

B.D.S. (2008)

Faculty of Dentistry Al Anbar University_ Iraq

Supervisors

Prof. Dr. Amr Mahmoud Abdel Aziz

Professor and Head of Pediatric Dentistry and Dental Public Health Department

Faculty of Dentistry Ain Shams University

Prof. Dr. Fouada Mohamed Ali Hedyia

Professor and Chairman of Psychological Studies Department

Childhood Postgraduate Studies institute
Ain Shams University

2015

الإسراء آية (85)

Dedication

This thesis is lovely dedicated to…

-The one, who has delivered his message, advised the nation, the prophet of mercy, our first teacher; ***Prophet Mohammed*** *(Peace be upon him).*

-The one, Allah has covered him with prestige and dignity, I carry his name proudly, his words are still shining such as stars to guide me today, tomorrow, and in the future, ***my beloved father****.*

-The meaning of love and tenderness, the smile of life, the secret of presence, the one that her prayers were the secret behind my success, the most beloved among all loves ***my beloved mother****.*

-The one who carried the hardships of the study with me, stood to my side, eased the difficulty of alienation, being the light that enlightens me towards success ***my dear husband.***

-Those, I see the optimism in their eyes, the happiness with their laugh, the faces filled with innocence, bloomed my days, opened new buds of my future, and the sight of my eyes, truly ***my children***

- Those, who supported, encouraged, and eased the difficulties of my study through their words and feelings; those who tolerated being far away from them to allow me to seek knowledge; ***my brothers and sisters.***

*-**My dearly loved country, Iraq,** I hope that my modest effort will contribute, one day, towards treating your wounds.*

*-Those who did not spare their knowledge or their time from me, those who contributed generously to this research, **my respected teachers and professors.***

*-**Each one who supported me, taught me**, even a letter.*

I dedicate my work, asking Allah Almighty to get the acceptance and success.

In the Name of Allah, the Most Beneficent, the Most Merciful

Acknowledgment

All praise are due to **Allah**. First and foremost I thank Allah, the generous, for having finally made this humble effort a reality.

The prophet said (whoever does not show gratitude to mankind is not grateful to **Allah*)***

I, therefor, express my deepest gratitude to all those who contributed directly or indirectly to bringing this publication to this final format, because I would never have been able, by myself, to achieve this.

I would like to thank all children and their parents whom participated in this study.

There are some people who deserve special thanks for guiding me and giving me of their precious time and help on seeing this job throughout, they are:

Prof. DR. Amr M. Abd Alaziz, professor and Head of pediatric dentistry &Dental Public Health Department, Faculty of Dentistry, Ain Shams university.

I would like to thank ***Prof. Dr.Fouada M. Hedyia***, professor and chairman of psychological studies Department, childhood postgraduate studies Institute, Ain Shams University.

Tables of Contents

List of Abbreviation……...……..I

List of Tables……...…….……..…...III

List of Figures……...……I v

Introduction……..……1

Review of Literature…….…...4

Aim of the Study……38

Patients and Methods…….…39

Results……59

Discussion…….….74

Summary…….…….……..80

Conclusion…….……....82

Recommendations……..……83

Appendix……....84

References……..……85

List of abbreviations

Abbreviation	Definitions
AMSA	Anterior middle superior alveolar
ASA	Anterior superior alveolar
MSA	Middle superior alveolar
P-ASA	Palatal- anterior superior alveolar
CCLADS	Computer-controlled local anesthetic delivery system
CHEOPS	Children's Hospital of Eastern Ontario pain scale
CNS	Central Nervous system
DPS	Dynamic pressure sense
IASP	International association for the study of pain
IO	Intraosseous
LA	Local anesthesia
PDL	Periodontal ligament
STA	Single tooth anesthesia
TENS	Transcutaneous electrical nerve stimulation
EDA	Electronic dental anesthesia
VAS	Visual analogue scale
VASOF	Visual analogue scale of face
FBRS	Frankl behavior rating scale
DFA	dental fear and anxiety
CFSS-DS	Children’s Fear Survey Schedule – Dental Subscale
IANB	Inferior alveolar nerve blocks
HR	Heart rate
FIS	Facial image scale
CIT	Computerized injection technique

ILI	Intraligement injection
PDP	Postoperative Dental Pain

List of Tables

Table 1: Frankle Behavior Rating Scale.....…..57

Table 2: The mean, standard deviation (SD) values and results t-test for the comparison between VASOF scores during injection between Girls and Boys……..……59

Table 3: The mean, standard deviation (SD) values and results t-test for the comparison between Frankle Behavior Rating Scores between Girls and Boys during injection and procedure.....…. 61

Table 4: The mean, standard deviation (SD) values and results t-test for the comparison of heart rate between Girls and Boys before, during injection, during procedure and post procedure……63

Table 5: The mean, standard deviation (SD) values and results of t-test paired 2 sample for means Comparison between VASOF scores after CCLADS and conventional injection techniques……..……...…….64

Table 6: The mean, standard deviation (SD) values and results of t-test paired 2 sample for means Comparison between VASOF scores before and after CCLADS and conventional injection techniques……66

Table 7: The mean, standard deviation (SD) values and results of t-test paired 2 sample for means Comparison between FBRS scores with the two techniques during injection and procedure …..……68

Table 8: The mean, standard deviation (SD) values and results of t-test paired 2 sample for means Comparison of H.R scores between the two techniques before, after injection and during, after dental procedure…….…….71

List of Figures

Figure 1: Computer-Control Local Anesthesia Delivery System (CCLADS)…….41

Figure 2: diagram of components of CCLADS STA system……44

Figure3: side-loading stainless steel aspirating syringe (conventional syringe)……..…45

Figure4: Pulse Oximeter…….……..….46

Figure5: The handpeice of CCLADS held with a pen- like grasp…50

Figure6: Infiltration injection administered with CCLADS……....51

Figure7: Infiltration injection administered with conventional syringe ……..53

Figure8: Visual Analog Scale of Faces……56

Figure9: The Oximeter was clipped to the thumb of the child's left hand……..58

Figure 10: VASOF during injection between Girls and Boys……..60

Figure 11: FBRS for Girls and Boys during injection……..62

Figure 12: FBRS for Girls and Boys during procedure…….…...62

Figure13: Bar chart representing Comparison between VASOF scores after CCLADS and conventional injection techniques……..65

Figure 14: Bar chart representing Comparison between VASOF scores before and after anesthesia in CCLADS……67

Figure 15: Bar chart representing Comparison between VASOF scores before and after anesthesia in conventional injection……67

Figure 16: Bar chart representing Comparison between FBRS scores with CCLADS and conventional techniques during injection of LA. ……..…….……..…..69

Figure 17: Bar chart representing Comparison between FBRS scores with CCLADS and conventional techniques during dental procedure…….……70

Figure 18: Line chart representing Comparison between H.R scores before CCLADS and conventional injections……72

Figure 19: Line chart representing Comparison between H.R scores after CCLADS and conventional techniques…….72

Figure 20: Line chart representing Comparison between H.R scores with CCLADS and conventional techniques during dental procedure.....…...73

Figure 21: Line chart representing Comparison between H.R scores with CCLADS and conventional techniques after dental procedure……..73

Introduction

*I*t is generally agreed that one of the most important aspects of child behavior guidance is the control of pain. If children experience pain during restorative or surgical procedures, their future as dental patients may be damaged. Therefore it is important at each visit to reduce discomfort to a minimum and to control painful situations. There are many pharmacologic pain control strategies to help children cope with these situations, both preoperatively and postoperatively. Most of these strategies involve the use of local anesthetics or analgesics[1]. Successful treatment of patients, especially pediatric patients, in terms of allaying their anxiety and discomfort during restorative and surgical procedures is facilitated by profound local anesthesia[2].

Local anesthesia and pain control is one of the most important elements of dentistry. Although local anesthesia techniques do not provide pain-free treatment, this pain is generally tolerable. Pain can result from the mechanical trauma of needle introduction into the site of injection, or from the sudden distension of the tissues, resulting from a rapid discharge of the contents of the syringe. Pain can also be caused by the stimulation of the first few drops of the local anesthetic[3]. Contrary to prevalent ideas, needle penetration of tissue is not the primary reason for discomfort, Volume and pressure of the local anesthetic being injected causes more distress and/or pain. Administering local anesthetic injection may not only provoke anxiety in patients but also in the dentist[4]. Despite that, administering local anesthesia by injection for pain relief is still the most common method

used in dentistry. However, there are several ways to alleviate pain before dental procedures begin or the often painful nature of the injection in local anesthesia [5].

Among healthcare professionals, dentists are often referred to as the local anesthesia experts, since providing localized anesthesia is an integral part their daily routine. Yet this is the one aspect that most patients dread when thinking of going to the dentist. Furthermore, it is often what prevents certain patients from having treatment. Today, there is little excuse for not using local anesthesia because it offers the advantage of child comfort, cooperation, and operator's better performance[7]. Often, patients tense up just at the thought of being "stuck" by the needle, and will delay or avoid treatment until tooth pain outweighs the perceived pain caused by injection of the needle. Treating pediatric patients can be even more of a challenge than apprehensive adults. If the appointment starts off with elevated patient emotions related to a painful injection, the rest of the appointment spirals down into a challenging patient management issue[6]. Numerous studies have been conducted in an effort to try to achieve a painless injection[7]. To deal with these concerns, Methods used to reduce pain during local anesthesia include: (1) application of topical anesthesia; (2) use of narrow needles; and others methods[8]. These techniques have held, but they have not eliminated the pain associated with anesthesia injections, and administrating local anesthesia with the traditional syringe continues to be painful for children and adult. Thus, dentists continue to search for techniques to make injections less painful. The sensation of pain during local analgesia (LA) delivery is a major issue in Pediatric Dentistry .Painless

LA delivery is mandatory, especially when used for preschool children, the need for painless LA becomes even more desirable[7].

In the mid-1990s, work began on the development of local anesthetic delivery systems that incorporated computer technology to control the rate of flow of the anesthetic solution through the needle. This concept is now called computer-controlled local anesthetic delivery (CCLAD). The first of these CCLAD devices, the Wand™ (Milestone Scientific, Inc., Livingston, N.J.), was introduced in 1997[9]. The "Wand" delivers anesthetic at a constant pressure and controlled volume, regardless of the resistance in the tissues. Slow injections can be regulated more precisely by this computerized system than the traditional syringe. Precise regulation is important because pressure and volume are thought to be directly related to pain. A computerized system, however, offers considerable promise of reducing pain precisely because it can control pressure and volume[10]**.** In 2006, the manufacturers of the original CCLAD, the Wand, introduced a new device, Single Tooth Anesthesia (STA™) which incorporates dynamic pressure-sensing (DPS) technology that provides a constant monitoring of the exit pressure of the local anesthetic solution in real time during all phases of the drug's administration. STA with DPS technology can be used to give anterior middle superior alveolar AMSA, Palatal- anterior superior alveolar P-ASA and Periodontal ligament PDL injections. It overcomes the problems associated with the traditional PDL injections. The system can be utilized for all traditional intraoral injection techniques. Since the pressure of the LA is strictly regulated by the STA system, a greater volume of LA can be administered with increased comfort and less tissue damage than seen with traditional syringes or PDL pressure devices[11, 12].

Review of literature

According to the (American Dental Association), fear of pain is the most important factor preventing patients from visiting their dentists. Different kinds of fear related to previous clinical experience affect patients' attitudes to local anesthesia or dentist. **Dental Fear** represents a normal emotional reaction to specific external stimuli considered threatening. Psychological fear of the dentist is associated with previous experiences or perceived negative experiences[13].

Dental fear is a specific type of fear, an individual emotional reaction to threatening stimuli, and is common among children and adults. The etiology of dental fear in children is multifactorial Dental fear has been related to personality, previous painful dental experiences, parental dental fear, age and gender. One of the most common fears patients report regarding dental treatment is fear of the dental injection · Anxiety about dental injections, though variable in degree from person to person , is almost universal . injection anxiety often creats abarrier to dental care,causing many patients to avoid or delay treatment[14,15].

However, dental anxiety is a multidimensional complex phenomenon occurring due to the dental treatment procedures. This phenomenon describes as a feeling or reaction to a known source of danger that lies in the subconscious. The concepts of dental fear and dental anxiety are often used interchangeably within the dental literature and anxiety is often used as a synonym for fear. Therefore, the terms 'dental fear' and 'dental anxiety' are combined 'dental fear and anxiety (DFA), and used from this point forward to indicate