COMPUTERIZED VERSUS TRADITIONAL TECHNIQUES OF ANESTHESIA USED IN ORAL SURGERY

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ABSTRACT

Aim of the study This review focuses on Computer-Controlled Local Anaesthetic Delivery systems (CCLAD) versus conventional carpule anaesthesia in its efficiency to reduce pain and anxiety. **Material and methods** For this purpose, we have searched for relevant studies in Science Direct, Thomson ISI - Web of Science, Scopus, PubMed, Google Scholar covering the period up to December 2018. We have included only the studies investigating oral surgery maneuvers that compared clinically CCLAD to conventional techniques. The authors looked mainly for data on pain, anxiety and effectiveness related to anaesthesia. **Results** The review provides a critical overview of 6 studies (n=325 subjects). **Conclusions** The review enabled the authors to draw the conclusion that CCLAD results in significantly lower level of pain perception compared to conventional injections, and it is a promising device for helping patients deal with pain perception. The literature needs to be expanded, mostly regarding anxiety and efficiency in oral surgery.

Key words: computed anesthesia system, tooth extraction, oral surgery, Wand system, Quicksleeper

INTRODUCTION

In dentistry, an effective local anesthesia is the first and the most important pillar upon which modern dentistry stands.(1) The injection of the local anesthetics is frequently associated with pain, despite of topical anaesthesia. Pain is a very subjective sensation encompassing level of anxiety, trust, personality and perceived control over the painful stimulus. (2–4) Dental patients have high expectations of the pain control management intra- and postoperative, and they become less tolerant with doctors that do not perform an atraumatic and effective anaesthesia.(5) In children, the level of maturation of physical, cognitive and emotional systems are also of influence.(4,6) Methods used to reduce pain during local anesthesia include: topical anaesthesia, pressure anesthesia, narrow gauge needles, slow injection rate, and solutions that are warmed and buffered.(7,8)

Studies showed that a continuous flow and an injection speed control of the anesthetic solution could determine a more comfortable and safe procedure. These criteria are exactly the main characteristics of the computed anesthesia systems. (9–11) In 1997, the Milestone Scientific Company (Piscataway, NJ, USA) was the first which introduced a

computerized system, named Wand.(1) The Wand system has three components: a base unit, a foot pedal, and a disposable handpiece assembly.(1,3)

Quicksleeper (Dental Hi-Tec, Cholet France) is also a computer-controlled anesthetic system, wherewith is possible to administer IO injection (transcortical, osteocentral), periodontal ligament injection (PLE), intraseptal injections, infiltration, and nerve block anesthetics. This anesthetic system is not recommended for procedures that take longer than 60 minutes. Also, in the case of surgical operations, the duration should be limited to 20 minutes owing to hemorrhage.(9,12)

Very few studies mention the Morpheus system (Meibach Tech Ltda., São Paulo, SP, Brasil), that is also a computer-controlled anesthetic system, which began to be marketed in Brazil in 2005. It uses the intraseptal technique of anesthesia.(13,14)

MATERIAL AND METHODS
Information sources

A literature search was performed for the present study in multiple databases (Science Direct, Thomson ISI - Web of Science, Scopus, PubMed, Google Scholar), and used the search terms showed in Table 1.

Eligibility criteria
The *inclusion* criteria for studies were:
- Crossover design, which is aimed to clinically compare CCLAD with conventional carpule anesthesia syringe
- Articles published between 2000-2018
- Articles related only to humans

The *exclusion* criteria were:

- Articles for which full text was not available
- Articles that were not in English

From the articles retrieved in the first round of search, additional references were identified by a manual search among the cited references.

Data collection
The following data was extracted from each report:
- the authors,
- the year of publication,
- the sample size,
- the range of age,
- the CCLAD (commercial product used),
- the type of anesthesia technique,
- the anesthetic solution used,
- the dental treatment following the anaesthesia,
- additional anesthetic use
- pain perception by the Visual Analogue Scale (VAS)
- assessment of anesthetic efficacy scale (AES) according to duration of operation

Table 1. Search terms

Keywords involved
Wand
Quicksleeper
Morpheus
Computerized anesthesia
Tooth extraction
Oral surgery
Dental anesthesia

RESULTS AND DISCUSSIONS

Study characteristics

Six studies were included in the review, as presented in Table 2. The total number of participants who were interviewed within the 6 studies is 325. The studies include patients from 5 to 63 years of age.

The 6 surveys are from 5 different countries: Italy, Brazil, India, Sweden, Turkey. Furthermore, all studies include males and females in their survey. These 6 articles analyze three different CCLAD: Wand Injection system, Quicksleeper, Morpheus (Table 2). All studies analyzed oral surgical procedures.

Table 2. Studies included in review

Authors	Publication year	Anesthetic techniques	Anesthetic solution	Intervention	Sample size	Age
Patini et al	2018	Wand: intraligamentary, Carpule: intraligamentary	2% mepivacaine with 1:100.000 epinephrine	tooth extraction	76	5-12 yr
Araujo et al	2015	Morpheus: IANB, Carpule: IANB	2% lidocaine with 1: 200,000 epinephrine	third molar extraction	29	18-40 yr
Mittal el al	2015	Wand: buccal and palatal infiltration, Carpule: buccal and palatal infiltration	2% Lidocaine with 1: 80,000 epinephrine	extraction of maxillary primary molars	100	8-12 yr
Jalevik et al	2014	Wand: palatal block anesthesia, Carpule: buccal fold and palatal infiltration	2% lidocaine with 1:80,000 epinephrine	bilateral minor maxillary surgical treatments	28	12-18 yr
Ozer et al	2012	Quicksleeper: IANB, Carpule: IANB	4% articaine with 1:100,000 adrenaline	impacted mandibular third molars	40	18-40 yr
Sumer et al	2006	Wand: IANB, Carpule: IANB	not mentioned	tooth extraction	52	18-63 yr

The perception of pain during injections is highly subjective and influenced by many psychologic factors, such as fear, anxiety, and past experiences.(7) The computed anesthesia system was developed for the purpose of controlling the anesthetic solution introduction with flow and injection speed control of the solution, being a comfortable and safe procedure for both the patient and the dentist.(9) Several studies that analyzed this system have shown that computerized anesthesia administration reduces the perception of pain as contrasted to the conventional technique.(7,9,15–17)

All the results of the studies included in this review are presented in Table 3.

In the study of Patini et al. (2018), the perception of pain was evaluated in seventy-six children aged from 5-12 years old being given intraligamentery anesthesia using CCLAD compared to conventional syringe anesthesia for teeth extractions. Their results showed that the mean pain score in CCLAD was 4.74 (2.8), and 5.51 (2.46) in conventional technique.(17)

Araujo et al. (2015) analyzed the Morpheus System versus conventional syringe when inferior alveolar nerve block was performed for third molar extraction. For the conventional technique 10.3% of patients needed additional anesthetic use, while for CCLAD 24.1% patients. Regarding the pain perception by VAS the results were: 3.45 ± 2.73 for conventional technique, and 2.8 ± 1.96 for computed anesthesia. The results of the study confirmed that CCLAD systems offer a less painful experience for the patients

compared to conventional techniques.(9)

The randomized controlled study of Mittal et al. (2015) compared the pain perception after buccal and palatal injection for Wand system and carpule syringe. The anesthetic solution used was 2% Lidocaine with 1: 80,000 epinephrine and the surgical intervention were extraction of maxillary primary molars. Patients experienced significantly less pain of injection with the computerized method during palatal infiltration (mean 2.38 ± 1.23) compared to the syringe anesthesia (mean 2.94 ± 1.35), while less pain was not statistically significant during buccal infiltration (for computerized method the mean value was 1.24 ± 0.74, and for conventional technique 1.16 ± 0.96).(16)

Jalevik et al. (2014) compared the perception of pain when using palatal block technique with Wand System, to conventional infiltration technique with traditional syringe in surgical procedures involving the palate. The injection pain was significantly lower when computerized technique was used (mean±SD 31.43±21.11), compared to

conventional injection (mean±SD 41.50 ± 22.60). (15)

In the study of Ozer et al. (2012), inferior alveolar nerve block was performed with either conventional mandibular anesthesia or intraosseous injection with Quicksleeper for the surgical removal of impacted mandibular third molars. Their study was the only one from this review that conclude that the duration of the anesthetic effect is inadequate for prolonged surgical procedures. The authors also stated that the duration of injection takes longer with computerized anesthesia systems. (18)

The study of Sumer et al. (2006) showed that the anxiety levels of patients were higher in Wand injection than conventional syringe injection, although the Wand System seemed to be less painful. The surgical maneuver was simple tooth extraction for which inferior alveolar nerve block was performed. Pain recordings using the Wand system on VAS (mean ± SD) were 2.67 ± 5.2 mm during the needle insertion, compared to 16.01 ± 14.1 mm for conventional technique.(7)

Table 3. Results of the studies

Authors	Additional anesthetic use for conventional technique	Additional anesthetic use for computed technique	Pain perception by the visual analogue scale for conventional technique (mean±SD)	Pain perception by the visual analogue scale for computed technique (mean±SD)	Assessment of anesthetic efficacy scale (AES) according to duration of operation - conventional technique	Assessment of anesthetic efficacy scale (AES) according to duration of operation - computed technique
Araujo et al	10.3%	24.1%	3.45 ± 2.73	2.8 ± 1.96	NS	NS
Jalevik et al	NS	NS	41.50 ± 22.60	31.43±21.11	NS	NS
Mittal el al	NS	NS	1.16 ± 0.96 (buccal) 2.38 ± 1.23 (palatal)	1.24 ± 0.74 (buccal) 2.94 ± 1.35 (palatal)	NS	NS
Ozer et al	NS	NS	NS	NS	Positive correlation of 34.5% between duration of operation and AO VAS	Positive correlation of 39.2% between duration of operation and AO VAS levels
Patini et al	NS	NS	5.51 ± 2.46	4.74 ± 2.8	NS	NS

Sumer et al	NS	NS	16.01 ± 14.1	2.67 ± 5.2	NS	NS

*NS=not specified

CONCLUSIONS

The review enabled the authors to draw the conclusion that CCLAD results in significantly lower level of pain perception compared to conventional injections, and it is a promising device for helping patients (adults and children) deal with pain perception.

Although CCLAD system have multiple advantages, with the studies available at this moment, we cannot conclude that the benefits exceed the costs of the device.

The literature needs to be expanded, mostly regarding anxiety and efficiency in oral surgery.

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