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Research Article

EVALUATION AND MANAGEMENT OF PER-OPERATIVE DENTAL PAIN IN CHILDREN AT THE CASABLANCA DENTAL CONSULTATION AND TREATMENT CENTER

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ABSTRACT

Background: Dental pain is one of the most dreadful pains, given its intensity, frequency, complications and impact on daily activities. This requires its fast diagnosis, evaluation and relief. Moreover, intraoperative pain must be managed quickly and effectively, especially in pediatric dentistry where the patient's confidence and anxiety level are strongly related to pain and its apprehension.In this sense, a study was conducted among children treated in the pedodontics department of the Dental Consultation and Treatment Center of Casablanca (DCTC), with the aim of determining the causes, characteristics, and means of managing intraoperative dental pain in children. **Methods:** A cross-sectional study was conducted on children aged 4 to 15 years consulting the dental emergency department and the pediatric dentistry department of the Dental Consultation and Treatment Center of Casablanca and whose care was provided in the same center by 5th year dental students. Data collection was performed using a four-part questionnaire. The first part defined the sociodemographic variables as well as the child's general condition, the second part assessed the child's behavior, the third part described the intraoperative pain, specifying its origin and assessment, and the fourth part specified the modalities of its management. Pain assessment was performed according to the recommendations of the National Agency for Health Accreditation and Evaluation, depending on the age of the patients. **Results:** This study showed that intraoperative pain was felt mainly during anesthesia (for 39.9% of the population), and more particularly during truncal anesthesia in 74.7% of the cases. The most painful dental procedure was related to the treatment of mandibular molars, especially during tooth extractions with 35.1%. The management of intraoperative pain consisted in the majority of cases of an increase in the dose of anesthesia. **Conclusion:** Dental pain in children is a subjective phenomenon that is difficult to identify, assess, and understand in its entirety, which is one of the major concerns of odontologists. This implies that the management of intraoperative pain in pedodontics must be concerned with understanding the pain in its entirety, correctly assessing this pain using scales adapted to the age and general condition of the patient, dissociating it from anxiety, which is sometimes difficult to achieve, and knowing how to manage it correctly intraoperatively.

Keywords: Pediatric Dentistry ; Anesthesia, Dental ; Pain Management.

INTRODUCTION

According to the International Association for the Study of Pain (IASP), pain is "an unpleasant emotional and sensory experience associated with present or potential tissue damage or described by the patient in such terms." This definition, described in 1978, implies sufficient cognitive development to locate and identify this experience and to communicate it [1]. A more recent definition was proposed in 2020, and identifies pain as "an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage" [2].

Dental pain is one of the most dreadful pains, given its intensity, frequency, complications and impact on daily activities. This requires its fast diagnosis, evaluation and relief. Moreover, intraoperative pain must be managed quickly and effectively, especially in pediatric dentistry where the patient's confidence and anxiety levels are strongly related to pain and its apprehension.

The subjective perception of dental pain experienced during dental care in children makes its evaluation and treatment difficult but necessary. This evaluation needs to be quantified and reproducible. It is possible to use validated scales that are sensitive, reproducible and specific, adapted to the child's age and general condition.

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In this sense, a study was conducted among children treated in the pedodontics department of the Dental Consultation and Treatment Center of Casablanca (DCTC), with the aim of determining the causes, characteristics, and means of managing intraoperative dental pain in children.

MATERIAL AND METHODS

A cross-sectional study was conducted on children aged 4 to 15 years consulting the dental emergency department and the pediatric dentistry department of the DCTC and whose care was provided in the same center by 5th year dental students. Patients with cerebral palsy (CP) and patients whose guardians refused to participate in the present study were excluded. The study lasted 3 months, from December 2014 to February 2014. This relatively short period of recruitment led to a small study size, and showcases a selection bias.

Data collection was performed using a four-part questionnaire.

The first part defined the sociodemographic variables as well as the child's general condition, the second part assessed the child's behavior, the third part described the intraoperative pain, specifying its origin and assessment, and the fourth part specified the modalities of its management. Pain assessment was performed according to the recommendations of the National Agency for Health Accreditation and Evaluation, depending on the age of the patients. To limit sources of bias, data collection was performed by one single operator, so no calibrating between operators was necessary.

Indeed, children aged 4 to 6 years benefited from a self-evaluation and a hetero-evaluation. The self-evaluation was performed with a two -sided ruler. The first side represented a Visual Analog Scale (VAS) [3], whereas the second side represented the Wong-Baker Faces Pain Scale (WBFPRS) [4], which was designed for them. The choice of pain intensity was made on one side, and the VAS translated this data to us in numerical form. Hetero-assessment was performed using the Children's Hospital of Eastern Ontario Pain Scale (CHEOPS) [5], which determines the degree of pain experienced and the need for intervention based on the child's behavior. Finally, children aged 7 to 15 years were simply self-reported using a VAS scale, considering that a child may be able to identify and grade correctly his pain levels on his own. These variables, especially the VAS scale, raised an important information bias, as it may be approaching the pain evaluation in a subjective way. Stress and anxiety may lead the child to grade his pain levels as being higher than what they were in reality.

Table I: Representative table of the variables studied

Sociodemographic variables	Child's behavior	Intraoperative pain variables	Pain management procedures
- *Age [4-6 years] and]6-15 years]* - *Gender* - *Socioeconomic status* - *General condition of the child*	According to the VENHAM scale modified by VEERKAMP. - At first contact - During the interview with the parents - At the installation in the dental chair - During the dental examination	- *Presence or absence of pre-operative pain* - *Presence or absence of painful experiences* - *ORIGIN OF THE PAIN* o *Anesthesia technique* o *Placement of the dam* o *Specific procedure* o Type of procedure o Maxillary or mandibular location o Tooth involved - *EVALUATION OF PAIN* *- 4 to 6 years:* *o Self-assessment with two-sided ruler:* *Side 1: VAS* *Side 2: WBFPRS* *o Hetero-evaluation CHEOPS.* *- 6 to 15 years: Self-assessment: VAS*	- *Increase in the dose of anesthesia* - *Change of anesthesia technique*

VAS, Visual analog scale
WBFPRS, Wong-Baker Faces Pain Rating Scale
CHEOPS, Children's Hospital of Eastern Ontario Pain Scale

Informed consent was signed by the guardians of each patient after explaining the purpose of the study, its objectives, and its benefits. The exploitation and analysis of the results were performed using EPI 6 software (Epi Info version 6).

RESULTS

A total of 150 patients were included in the present study. Their distribution according to age, sex, socioeconomic level according to the WHO classification and general condition is described in Table II.

Table II: Representative table of socio-demographic variables and general condition of the patients in the present study.

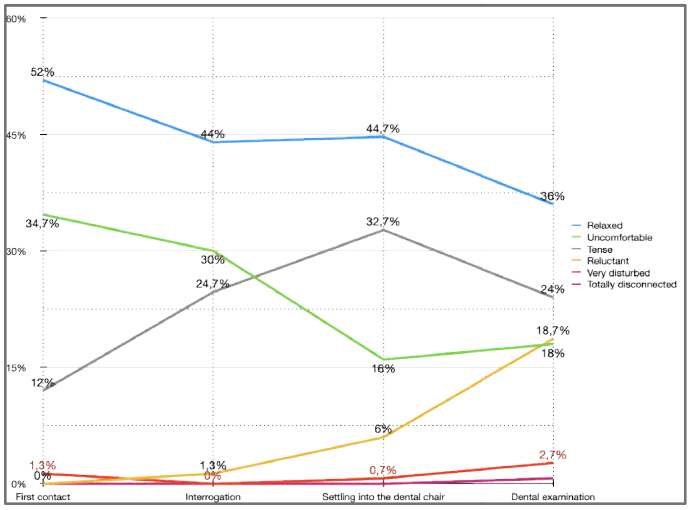
VARIABLES	NUMBER (N)	PERCENTAGE (%)
Age (Years)		
[4-6] yr.	46	30.7
]6-15] yr.	104	69.3
Sex		
F	64	42.7
M	86	57.3
Socio-economic level		
Low	83	55.3
Medium	59	39.3
High	8	5.4
General condition		
Good general condition	125	83.3
General pathology	25	16.7

The evolution of the child's behavior according to the VENHAM scale modified by VEERKAMP is presented in Table III, during the different phases of the treatment, i.e., during the first contact, the interrogation, the installation in the dental chair and during the dental examination. The first contact was characterized by a majority of children being relaxed in 52% of the cases. This proportion decreased slightly during the interview to 44%. The progression of the treatment required the patient to be placed in a chair, with the same rate of relaxed children. Finally, the dental examination showed a decrease in this percentage, with a total of 36% of relaxed children. If we look at the evolution of the "tense" behavior, we find that the percentage of children adopting this behavior is increasing throughout the care, with 12% of tense children during the first contact, 24.7% during the interview and 32.7% during the installation in the chair. The dental examination showed a clear increase in the rate of reluctant, very disturbed and totally disconnected children. The overall results are described in Table III, and Fig. 1.

Table III: Representative table of the child's behavior during the different phases of care according to the VENHAM scale modified by VEERKAMP

	PHASE OF CARE	NUMBER (N)	PERCENTAGE (%)
First contact	Relaxed	78	52
	Uncomfortable	52	34.7
	Tense	18	12
	Reluctant	0	0
	Very disturbed	2	1.3
	Totally disconnected	0	0
Interrogation	Relaxed	66	44
	Uncomfortable	45	30
	Tense	37	24.7
	Reluctant	2	1.3
	Very disturbed	0	0
	Totally disconnected	0	0
Settling into the dental chair	Relaxed	67	44.7
	Uncomfortable	24	16
	Tense	49	32.7
	Reluctant	9	6
	Very disturbed	1	0.7
	Totally disconnected	0	0
Dental examination	Relaxed	54	36
	Uncomfortable	27	18
	Tense	36	24
	Reluctant	28	18.7
	Very disturbed	4	2.7
	Totally disconnected	1	0.7

Fig. 1 - Graph showing the evolution of the child's behavior during the different phases of the treatment according to the VENHAM scale modified by VEERKAMP



Intraoperative pain was experienced by 72% of population, i.e., 108 patients out of 150. Its origin was diverse, with 40.7% of the patients reporting pain both during the anesthesia and during dental care, 39.9% only during the anesthesia and 11.1% only during the dental procedure. The most painful anesthesia was truncal anesthesia in 74.7% of the children surveyed, while the most painful dental procedure was the extraction of mandibular teeth in 33.3% of the patients. The results are detailed in Table IV, V and VI.

Table IV: Table representing the distribution of procedures causing pain in the population of the present study

ACTS CAUSING PAIN	N	%
Anesthesia	43	39.9
Dam	4	3.7
Surgical procedure	12	11.1
Anesthesia + surgical procedure	44	40.7
Anesthesia + dam	4	3.7
Dam + surgical procedure	1	0.9
Total	108	100

Table V: Representative table of the type of anesthesia causing pain in the patients interviewed in this study

TYPE OF PAINFUL ANAESTHESIA	N	%
Papillary	1	1.1
Intra-septal	4	4.4
Para-apical	5	5.5
Truncal regional nerve block	68	74.7
Para apical and Truncal regional nerve blocks	2	2.2
Papillary and para-apical	4	4.4
Other type of anesthesia	7	7.7
Total	**91**	**100**

The dental procedure, whatever its type, was felt to be more painful when it was performed at the mandibular level, both for temporary and permanent teeth (Table VI)

Table VI: Representative table of the type of painful dental procedure in the patients interviewed in this study.

TYPE OF PAINFUL DENTAL PROCEDURE	N	%
Caries treatment of a temporary maxillary tooth	1	1.7
Caries treatment of a temporary mandibular tooth	2	3.5
Caries treatment of a permanent maxillary tooth	3	5.3
Caries treatment of a permanent mandibular tooth	5	8.8
Pulp treatment of a temporary maxillary tooth	2	3.5
Pulp treatment of a temporary mandibular tooth	3	5.3
Pulp treatment of a permanent maxillary tooth	1	1.7
Pulp treatment of a permanent mandibular tooth	7	12.3
Maxillary tooth extraction	6	10.5
Mandibular tooth extraction	20	35.1
Maxillary and mandibular tooth extraction	7	12.3
Total	**57**	**100**

Intraoperative pain was assessed differently depending on the age of the child. There were 31 children aged 4 to 6 years who experienced intraoperative pain, and both self-evaluation and hetero-evaluation were used. According to the VAS, 58.1% of the patients would have described their pain as intense to very intense, whereas according to the WBFPRS scale, 74.2% of the patients would have rated the pain as intense to very intense. In view of the mismatch between the two scales, it was necessary to rely on the CHEOPS hetero-evaluation scale, where 25.8% of patients aged 4 to 6 years required therapeutic intervention according to the National Agency for Health Accreditation and Evaluation recommendations. All the results are detailed in Table VII.

The evaluation of intraoperative pain in patients over 6 years of age was carried out solely by means of a self-assessment using a VAS scale, and showed that 50% of our sample judged the intraoperative pain as moderate, 22.4% as mild and 18.4% as very severe.

Table VII: Representative table of the different methods of pain assessment in patients aged 4 to 6 years in the present study.

	PAIN ASSESSMENT	N	%
VAS	Mild	8	25.8
	Moderate	5	16.1
	Intense	3	9.7
	Very intense	15	48.4
Total		31	100
WBFPRS			
	Mild	5	16.1
	Moderate	3	9.7
	Intense	0	0
	Very intense	23	74.2
Total		31	100
CHEOPS			
	6	12	38.7
	7	7	22.6
	8	4	12.9
	9	1	3.2
	10	3	9.7
	11	0	0
	12	1	3.2
	13	3	9.7
Total		**31**	**100**

VAS, Visual Analog Scale
WBFPRS, Wong-Baker Faces Pain Rating Scale
CHEOPS, Children's Hospital of Eastern Ontario Pain Scale

Intraoperative pain management was carried out in 25.9% of our sample, essentially by changing the anesthesia technique, increasing the dose or combining the two techniques. The different modalities of this management are described in table VIII.

Table VIII: Representative table of intraoperative pain management in the population of the present study.

PAIN MANAGEMENT	N	%
Increase in the dose of anesthesia	16	14.8
Change in anesthesia technique	6	5.6
Increase in dose + change in technique	1	0.9
Contact anesthesia + change in technique	3	2.8
Contact anesthesia + dose increase	2	1.8
No management	80	74.1
Total	**108**	**100**

DISCUSSION

The perception of dental pain, however physical, is particularly influenced by the psyche of the person, especially for those who have had a previous painful experience. Hence the relevance of carefully studying the evolution of the child's behavior during the different phases of his or her management. Indeed, according to a 2013 study by Chia-shuLin [6], the phenomenon of pain avoidance and anticipation causes people who dramatize to show excessive attention to pain, exaggerate the intensity of the pain they are about to experience, and feel unable to cope with their suffering. During dental treatment, such an attitude is associated with a decreased pain threshold, increased perceived pain intensity, significant anxiety and negative thoughts about pain and dental procedures. The link between actual pain, pain anticipation, and dental fear is well established [7,8]. When assessing the behavior of the study population, we noted that the child's anxiety was particularly intense both during the clinical interview and during the installation in the dental chair. According to the MUPPA and Col study, this can be explained by the hospital environment, the waiting time, the unusual sounds coming from the treatment room, and the fear of the unknown, which would lead to the young patient's apprehension [9]. However, the patients' tense behavior improved significantly between the time they were seated in the dental chair and the start of the dental examination. This improvement is probably due to the different psychological approach methods adopted by the practitioner, which would allow the child to get over his own worries and realize that the reality of a dental treatment is much less frightening than in his imagination. These findings are consistent with Peretz's study of 104 young adolescent patients in which he found that anxiety decreased after sitting in the dental chair [10].

There are methods for managing anxiety in children from an early age, some of which are based on sedation of the patient. It may consist of medical treatment, using hydroxyzine, or conscious sedation with a Nitrous Oxide Equimolar Mixture (NOPM). Providing these different levels of sedation during dental procedures requires a rigorous treatment plan. [11,12].

Intraoperative pain is high in the population of the present study, where it was experienced in 72% of the cases, originating either from the dental act itself or from the anesthetic procedure. This high rate of pain experienced during anesthesia can be explained by the lack of use of contact anesthesia or cryoanesthesia prior to injection, insufficient tissue traction to saturate the nociceptors, but also patient anxiety exacerbating the feeling. Truncal anesthesia was considered the most painful in 61.5% of the population.

Sharaf in his study comparing infiltration anesthesia and mandibular locoregional anesthesia in 80 patients aged 3 to 9 years concluded that locoregional anesthesia was more painful than infiltration anaesthesia [13], especially since this type of anesthesia performed in children aged 3 to 5 years negatively influenced their behavior during subsequent sessions by a phenomenon called pain memory [14].The pain experienced with truncal anesthesia can also be justified by the greater penetration of the needle than with local anesthesia to deposit the anesthetic product opposite the Spix spine. During this deep infiltration, the needle crosses several innervated muscular structures, which generates a painful perception. This anesthesia technique implies a good mouth opening which can generate pain especially in case of trauma or infection.

However, there are new anesthesia methods different from the traditional anesthesia technique, which could considerably reduce the child's anxiety and make him accept the surgical act much more easily. In an article published in the Journal of Dental Anesthesia and Pain Medicine in 2018, new technologies to help the patient reduce injection pain and minimize adverse effects prior to infiltration of the anesthetic agent were presented, and include electronic anesthesia, needle-free jet injectors, iontophoresis, or computer-controlled local anesthesia [15,19].There is little evidence in the current literature regarding the use of these methods of anesthesia, although these techniques remain promising. A case series of 50 children receiving intraosseous anesthesia using a computer-controlled anesthesia device conducted in 2012 showed that the majority of children experienced no pain or merely mild discomfort (Score of 0 to 2 for 91. 8% of children according to the face scale, and for 83.9% of children according to the VAS) [19]. In addition, another study showed that 58.9% of children who had undergone dental anesthesia reported that computerized intraosseous anesthesia was more comfortable than traditional infiltration methods [20].

Thus, although these new procedures are generally accepted by patients to date, their effectiveness has often been reported to be

limited compared with traditional anesthesia. Intraosseous anesthesia appears to be the most effective and promising procedure for delivering anesthetic in a painless manner. However, the high cost and time required to provide dental anesthesia must be taken into consideration.

Regarding the most unpleasant procedures identified in the present study, it was observed that the more invasive the procedure, the more likely it was to be unpleasant. Indeed, cavities treatment procedures were considered painful in 19.3% of cases, compared to 22.8% of pulp procedures and 57.9% of extractions. These results are consistent with a study by Ghanei *et al.,* where tooth extraction was found to be painful in 62.4% of cases, while conservative treatments accounted for only 38.8% [21]. Also, 65% of the painful procedures were related to mandibular teeth, whether for extraction or pulp treatment. There is significant variability in the reported failure rates of mandibular anesthesia, with up to 48% failure in a US study [22]. Many factors contribute to mandibular anesthesia failure, with many of these factors being beyond the control of the practitioner, such as patient cooperation, facial morphology, preoperative pain [23], patient anxiety, insufficient volumes of local anesthetic solution, or the presence of inflamed or infected tissue [24]. In addition, there are anatomical variations [25] that prevent good local anesthesia from being achieved in the mandible, especially in children where the location of the Spix spine varies with age. Pain assessment should be done using scales adapted to the child's age and abilities (Table IX).

Table IX: Representative table of the minimum appropriate age for the use of pain assessment scales according to certain studies.

TYPE OF SCALE	MINIMUM APPROPRIATE AGE
Color scale[1]	4
Face scale[2]	5
Visual analog scale[3]	6
Digital scale[4]	8
Simple verbal scale[5(p)]	9

In the present study, and according to the National Agency for Health Accreditation and Evaluation recommendations, pain intensity was measured using the Visual Analog Scale or the Wong-Baker Face Pain Rating Scale (WBFPRS) in the case of self-evaluation, or the CHEOPS scale in the case of hetero-evaluation. In children under 6 years of age, 58.1% of them rated their pain as intense to very intense according to the VAS, compared with 74.2% according to the WBFPRS. These results diverged in 29% of cases, and therefore only the results of the hetero-evaluation were retained, where 25.8% of patients required management. Also, only 27.6% of the patients aged 7 to 15 years rated their pain as severe to very severe. Thus, intraoperative dental pain was judged to be more intense in children aged 4 to 6 years, and this is probably due to the young age of the patients, the apprehension of the pain increasing their feeling and the difficulty of dissociating pain and anxiety for this age group [26].

Finally, 25.9% of the population studied had received pain management. The latter consisted in increasing the dose of anesthesia for 14% of the sample and changing the anesthesia technique for 5.6%. The literature has shown that pediatric dentists tend to be indifferent to the child's pain, judging it to be exaggerated or false, more related to the patient's anxiety than to the surgical procedure itself, so that they tend not to use pain management methods intraoperatively.
In fact, a study of 198 dentists in the United States showed that 10% of the doctors surveyed were unaware of the child's pain and would not believe that the pain reported was real. It was found that practitioners who wanted to have a high degree of control over the child were less likely to administer local anesthesia, while dentists who regularly questioned the child about his or her comfort were more likely to administer an additional dose of local anesthesia depending on the patient's discomfort [32]. Another study involving a sample of North American and Finnish practitioners showed that 67% of American dentists and 21% of Finnish dentists did not consider pain reported by their young patients to be credible enough to act on. The study found that there was no relationship between the practitioner's intraoperative pain management and the perception of pain experienced by their patients [33]. Also, a final study analyzing the different attitudes of Swedish dentists towards pain and its intraoperative management in children and adolescents showed that almost half of the practitioners thought that children had difficulty differentiating between pain and discomfort, with one-third of them rating young children as reporting pain with great uncertainty. The results also showed that 35% of dentists were indifferent to managing their patients' pain experiences, and were not interested in the psychological approach to young patients [34].

Some biases related to the survey could not be addressed despite the rigor of the data collection.First of all, the relatively short period of recruitment led to a small study size, and showcased a selection bias, meaning that our study didn't show exhaustivity during the selection period. This study can be considered as an exploratory study, as the results obtained cannot be generalized to the general population. However, it could serve as a basis for other studies on a larger scale.
To limit sources of information bias, data collection was performed by one single operator, so no calibrating between operators was necessary. However, certain variables, especially the VAS scale, raised an important information bias, as it may be approaching the pain evaluation in a subjective way. Stress and anxiety may lead the child to grade his pain levels as being higher than what they were in reality. A more objective evaluation may have been done using vitals like the children's heart rate or blood pressure, which are better indicators. The devices needed to measure these variables were unfortunately not available.

CONCLUSION

Dental pain in children is a subjective phenomenon that is difficult to identify, assess, and understand in its entirety, which is one of the major concerns of odontologists. This implies that the management of intraoperative pain in pedodontics must be concerned with understanding the pain in its entirety, correctly assessing this pain using scales adapted to the age and general condition of the patient, dissociating it from anxiety, which is sometimes difficult to achieve, and knowing how to manage it correctly intraoperatively. This study showed that intraoperative pain was felt mainly during anesthesia, and more particularly during truncal anesthesia. The most painful dental procedure was related to the treatment of mandibular molars. The management of intraoperative pain consisted in the majority of cases of an increase in the dose of anesthesia.

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