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**УПРАВЛЕНИЕ ПОВЕДЕНИЕМ
И КОНТРОЛЬ БОЛИ У ДЕТЕЙ**

**BEHAVIOR MANAGEMENT
AND PAIN CONTROL IN CHILDREN**

Учебно-методическое пособие



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Посвящено вопросам управления поведением детей разного возраста во время стоматологического лечения. Приведены психофизиологические особенности детей в разные возрастные периоды, влияние родителей на восприятие ребенком стоматологических процедур. Рассмотрены способы немедикаментозной и медикаментозной коррекции поведения маленьких пациентов во время визита к стоматологу, подготовки к посещению врача, показания и противопоказания к лечению под наркозом и седацией. Детально рассмотрены особенности выполнения местной анестезии у детей с учетом анатомо-физиологических особенностей зубочелюстной системы в различные возрастные периоды.

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INTRODUCTION

Helping the child to accept dental treatment without a negative experience that might influence the way the child views dental treatment and consequently dental health in the future is one of the most important skills that a paediatric dentist must have.

Effective communication with children is of great value, as “being good with younger patients” can reduce stress during clinical treatment.

The successful management of children in dentistry depends on the team effort of the parent, the dentist, the dental team and the ambience of the clinical environment. Everything plays their part.

General anesthesia is widely used in paediatric dentistry more often when extracting teeth.

The use of general anesthesia in paediatric dentistry has a wide application, usually for the extraction of teeth. Fortunately, referrals have reduced, due to both the reduction of dental disease and to the use of sedation. Nevertheless, there will always be a need for general anesthesia in dentistry, especially for pre-co-operative children.

This book deals with the use of local anesthesia in children and describes injection methods that should produce minimal discomfort. The complications and contraindications to the use of local anesthesia in children are also discussed. The major use of local anesthetics is in providing operative pain control. It should not be forgotten, however, that these drugs can be used as diagnostic tools and in the control of haemorrhage.

PSYCHOLOGICAL FOUNDATIONS OF CHILDREN BEHAVIOR

The foundation of practicing dentistry for children is the ability to guide them through their dental experience. In the short term, this ability is a condition for providing for their immediate dental needs. More long-lasting beneficial effects can be formed when the seeds for future dental health are planed early in life.

The process of leading a child through a dental appointment had for many years been termed “*behavior management*”.

- Behavior is defined as any change in the functioning of an organism.
- Behavioral dentistry is comprehensive methodology meant to develop a relationship between the child and the pediatric dentist.
- It should be viewed as the sum of all efforts made to achieve patients’ trust and confidence; to relieve his pain and fear.

The aim of behavior management is to promote positive dental attitudes, it does not mean just the behavior necessary to complete a given task, but includes creating a long-term interest for the patient’s part for ongoing visits. So the dentist must establish a relationship based on trust with the child and parents to ensure compliance with preventive regimes and allow treatment to occur.

A major difference between the treatment of children and the treatment of adults is the relationships. Treating adults generally involves a one-to-one relationship, that is, a dentist-patient relationship. Treating a child, however, usually relies on a one-to-two relationship among dentist, pediatric patient, and parents. This relationship, is known as the pediatric dentistry treatment triangle (Fig.). Recently, society has been centered in the triangle. Note that the child is at the apex of the triangle and is the focus of attention of both the family and the dental team.

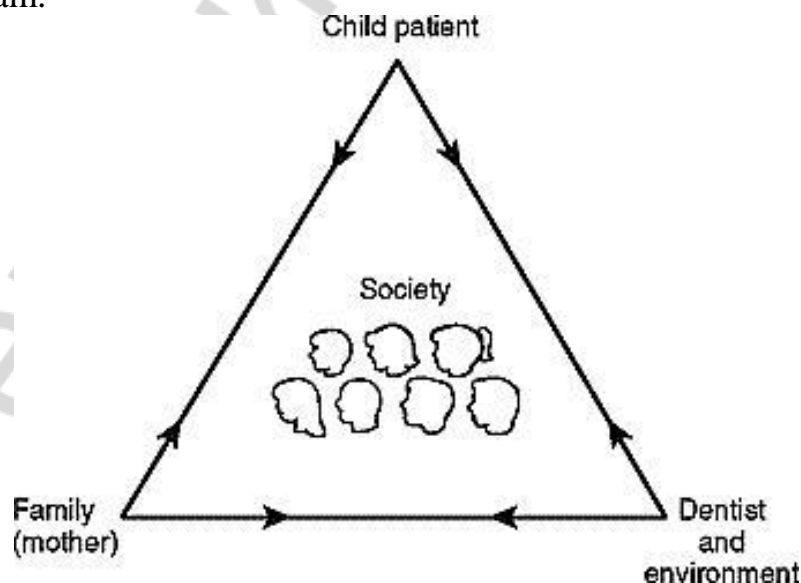


Figure. The pediatric treatment triangle illustrates basic relationships in pediatric dentistry

Because changes are constantly occurring within each personality, one must remember that there is an ever-changing, dynamic relationship among the corners of the triangle — the child, the family, and the dental team. The arrows placed on the lines of communication also remind us that communication is reciprocal.

PEDIATRIC DENTAL PATIENT

The responses of children to the dental environment are diverse and complex.

Children are different in ages, maturity, temperament, experience, family background, culture and oral health status.

Factors influencing child's behaviors:

A-Factors involving the child.

B-Factors involving the parents.

C-Factors involving the dentist.

Factors involving the child

They include growth and development, medical history, past dental experience, the position of the child in the family, the socio-economic status of the family.

Growth and development. First of all, the child's behavior in the dentist's office is determined by its level of development. Child development involves more than physical growth, and means a sequential unfolding that may involve changes in size, shape, function, structure, or skill.

Development is a life-long process and includes motor developments, cognitive, perceptual, language and social development. The most important general principle concerning development is that human development is not unitary.

Child age classification:

- Newborn: birth to one month.
- Infants: one month to 12 months.
- Toddlers: one year to 2–3 years.
- Preschool: three to six years.
- School age: six to 11/12 years.
- Adolescent: 12–18/20 years.

Personality characteristics related to specific chronological ages that have relevance to dentistry are shown in Box 1. These can help when developing behavioral guidance strategies. For example, if dentist knows the limitation of 2-years-old's vocabulary, it becomes apparent that communication must occur through the sense of touch and voice modulation rather than through the spoken word.

Age-Related Psychosocial Traits and Skills for 2-to 5-Year-Old Children

<p>TWO YEARS Geared to gross motor skills, such as running and jumping. Likes to see and touch. Very attached to parent. Plays alone; rarely shares. Has limited vocabulary; shows early sentence formation. Becoming interested in self-help skills</p>
<p>THREE YEARS Less egocentric; likes to please. Has very active imagination; likes stories. Remains closely attached to parent</p>
<p>FOUR YEARS Tries to impose powers. Participates in small social groups. Reaches out — expansive period. Shows many independent self-help skills. Knows “thank you” and “please”</p>
<p>FIVE YEARS Undergoes a period of consolidation; deliberate. Takes pride in possessions. Relinquishes comfort objects, such as a blanket or thumb. Plays cooperatively with peers</p>

Each age has its own features of psychology and perception of the world, as well as response and reaction to it. Normally children go through different psychological developmental stages as they grow up. As they grow, their motor functions, vocabulary, flexibility and individuality improve.

At the same time, it should be noted that the development is a very individual process and there is no clearly marked relationship between chronological and psychological age.

Medical history / Medical experience. Children who view medical experiences positively are more likely to be cooperative with the dentist. Children who have had negative experiences associated with any medical treatment may be more anxious about the dental treatment.

Pain during previous medical visits is significantly correlated with children’s behavior in the dental environment.

Previous surgical experiences influence behavior at the first dental visit, but this was not the case in subsequent visits.

Taking a medical history the dentist should include questions about previous hospital/medical contact/treatment and the child’s response to them.

Dental experience. Children who know they have a dental problem are more likely to exhibit negative behavior at the first dental appointment. The problem may be serious such as a chronic dental abscess or a simple one

such as extrinsic staining of the dentition. The pain may be moderate or intense, real or imaginary. However, there is a tendency toward negative behavior at the first dental visit when the child believes that a dental problem exists.

A common cause of children's dental fears and bad behavior is a pain during previous dental visits:

- the memory of the earlier infliction of pain during treatment or tooth extraction;
- the perception of the dentist as a source of pain and punishment.

Such considerations provide the dentist greater motivation for educating the parents about value of establishing a dental home care early, before any dental problems develop.

Position of the child in the family. Arrangement of the children in the family offers their behavior. Children character is shaped by many factors, but position in the family is especially important because it's continuously reinforced throughout life.

After all, childhood is a time when we form all our habits, characteristics and personality. Birth order is considered by some researchers and psychologists to be one of the most powerful influences on personality, along with genetics, gender, temperament and parenting styles. The position in the family (the eldest child, a middle one, the youngest or an only child) can have a powerful impact on his character.

Socio-economic status of the family. Children from families with low socio-economic status have poor dental health and early gain experience of toothache and dental emergency aid, and therefore often have problems of dental fear and general behavior problems.

Factors involving parents

Parents play a very important role in child's psychological development which has a profound effect on the behavior of a child.

Children learn basic aspects of everyday life from their parents, this process is called socialization and is ongoing and gradual. Interestingly, primary socialization can have a profound and lasting effect. For example, fear of dental treatment and when we first begin to clean our teeth can often be traced back to family influence. So parents can shape a child's expectations and attitudes about oral health; thus, every attempt should be made to involve them when attempting to offer dental care or change a child's health habits.

Factors influencing child's behavior are: parent-child relationship, maternal anxiety and parents' attitude to dentistry.

Parent-child relationship. The parental influence may be grouped under following headings:

1. *Overprotective parents:* they take excessive care of their children. These parents do not allow their children to experience and learn to cope with

their problems and anxieties of life. Overprotection may relate to the previous history of miscarriage, death of any other sibling or serious illness of the child. As a result, the child is frequently very shy, fears new situations and lacks self-confidence.

2. *Overindulging parents.* Here parents give child whatever they want without any restraint. The child manipulates his parents into satisfying all of his wants and tend to act superior, bossy, and demanding. Typically, he follows the same type of behavior during dental visits and is often called a “spoiled” child.

3. *Authoritarian parents.* Here the parents try to instill a high level of discipline in the form of physical punishment and verbal ridicule. Such parents neglect their children anxieties and constantly criticize or punish them. They may compare them with older siblings and demand the same behavior. These children will be submission and use delaying tactics in an attempt to avoid any dental procedures.

4. *Under affectionate parents (unloving):* the child is devoid of love and affection. In this case parental behavior ranges from mild lack of interest to neglecting or physical abuse. The lack of affection and attention to their children may result in severe emotional problems. The child usually develops resentment and non-responsive to painful procedures or might also be loud, crying easily and aggressive seeking the attention that is missing at home.

5. *Rejecting parents.* Children face such situation when parents have an unwanted child, unhappy marriage, child interfering parents career etc.

It is found that children's behavior in the dentist's offices is strongly related to parenting styles, preferences and demands. Parents` inability to set limits for their children is the main child-rearing problem.

In their practice dentists have to anticipate these types of problems and learn to fight against them. It is suggested several methods of coping with parent's and children's behavior.

Parental anxiety. Interestingly, families also have a profound influence on levels of dental anxiety among their children. Dentally anxious mothers have children who exhibit negative behavior at the dentist's. Investigations indicate a significant correlation between mother's anxiety and child's behavior at the first dental visit. Although it is known that children of all ages can be affected by their mothers' anxieties, the effect is greatest with those younger than 4 years of ages. Hence, the need for dentists to look “beyond” the child when assessing the reasons for dental anxiety.

Although mothers' attitudes significantly affect their children's behavior at the dentist's office, the roles of families have been changing, and the family environment must be considered.

Attitude of parents to dentistry: parents with positive dental attitude will develop the same in the child.

Factors involving the dentist

The following factors are very important in the organization of children's dental reception: appearance at the dentist's office; personality of the dentist; skills and speed of the dental team; time and length of the appointment.

The dental environment. The clinical area for children should be designed in such a way as to put children at ease. It should be carefully designed, welcoming, non-threatening and safe, yet able to function clinically.

The dental clinic should be pleasing and attractive. To achieve this, the reception area should be made as comfortable and warm as possible. The clinic environment should relax the patient and keep him engaged until his treatment begins. It should have a playroom and be well equipped with toys, tape recorders, TV (showing cartoons), aquarium, cartoon posters and etc. Children mustn't see adults in pain.

Dentist's manner and appearance. The way a dentist interacts with patients will have a major influence on the success of any clinical or preventive care.

A pediatric dentist must love children and be able to communicate at the level of the child's understanding. Ideas and concepts have to be explained in terms easily understood by the child. The use of "childrenese" terms helps explain dental instruments and procedures in a non-threatening manner that is acceptable to most children. Genuine interest in the child's welfare can be transferred to the child and help them feel more secure and safe. Some personality types are able to do this naturally without thinking, whilst others may have to learn these skills.

It seems that the dentist's attire is not as important as general cleanliness and neatness. Personal hygiene is most important. However, some children do suffer from "white-coat" syndrome and a dentist wearing child-friendly attire may help alleviate some anxiety.

Protective equipment like facemasks and goggles are accepted well by the patients if worn after a brief explanation of their roles and function. They have less influence on subsequent behavior.

Personality of the Dentist. Children are not small adults; thus an understanding of the child development is very important if behavior management techniques are to be used effectively.

Also the reaction of the child is not a fixed pattern but differs from time to time and from child to child. The dentist should be able to modify his approach and language with children to match their abilities and understanding.

It is extremely important that the dentist learn to mask his emotional reactions toward situations and never lose his temper as this will create a feeling of success in the mind of the child and will encourage the child for all future dental visits. The dentist can help the child to display good behavior by permitting him to express feelings and listen to him.

Dentist must be calm, smile and show friendly attitude and may express disapproval to the unacceptable behavior without losing personal control.

The child should always be called by his or her nick name or at least the first name. All conversation should be directed towards the child and the dentist should not talk in a loud voice or shake hands vigorously. If parents are present then involve them into the conversation, but do not forget that the child should be in the center of the developing relationship.

Building trust and empathy with the child are two most important basic principles of the successful management of a child in the dental environment. A trusting relationship with the dentist increases the child's acceptance of dental procedures and the success of treatment will further strengthen trust and rapport.

Dental team skill and speed. Dental treatment should be performed in a pre-planned manner to avoid any loss of time. A child can endure discomfort if he knows it is going to end a bit later. Four-handed assistant with excellent communication skills is important in the management strategies.

Time and Length of Appointment. Children are not "little adults", they are vulnerable and afraid of new surroundings so effective time management is important. Try to see young patients on time and do not stress yourself or the child by expecting to complete a clinical task in a short time on an apprehensive patient.

Children cannot sit in one position for a long time and their threshold of tolerance is very low, therefore they should not be kept in the chair for periods longer than half an hour. Children should not be given appointment during their naptime or soon after some emotional experience such as birth of a sibling or death of someone close.

The appointments should be kept preferably in the morning time. Duration of visits: procedures should be distributed at the reception so there is no need to hurry, but do not get bored.

Dental anxiety

Dental anxiety should concern us as professionals because it doesn't only prevent many potential patients from seeking care but it also causes stress to the dentists giving dental treatment. However, anxiety and dental care seem to be a locked topic in the general folklore of many countries.

Many definitions of anxiety have been suggested. However, it would seem sensible to consider the comments of Kent (see Kent and Blinkhorn 1991) who reported that *anxiety is "a vague unpleasant feeling accompanied by a premonition that something undesirable is going to happen"*. In other words, it relates to how people feel — a subjective definition. Another point of view is that anxiety manifests itself in behavior. If, for example, a person is anxious, then she/he will act in a particular manner. A person will avoid

visiting the dentist. Thus, anxiety should be seen as a multi-factorial problem made up of a number of different components, all of which can exert an effect.

Anxiety must also be seen as a continuum with fear — it is almost impossible to separate the two in much of the research undertaken in the field of dentistry, where the two words are used interchangeably. One could consider that *anxiety is more a general feeling of discomfort, while fear is a strong reaction to a specific event*. Nevertheless, it is counterproductive to search for elusive definitions as both fear and anxiety are associated with dental visiting and treatment.

Some people may develop such a fear of dentistry that they are termed phobias. *A phobia is an intense fear which is out of all proportion to the actual threat*.

Phobia should be distinguished from anxiety. Dental anxiety is a state of apprehension regarding the dental treatment. It is normal for people to be anxious about situations which are perceived to be painful. Dental phobia, on the other hand, is an irrational, intense, persistent fear of certain aspects of dental treatment, such as needle phobia.

Classification of children's behavior patterns

Measuring dental anxiety is problematic because it is based on subjective measures, plus the influence of the parents, the dentist's behavior, and the reason for a visit may all exert some effect on a child's anxiety level.

Numerous systems have been developed for classifying the behavior of children in the dental environment. The knowledge of these systems can assist the dentist to manage the patient's behavior.

Frankl Behavioral Rating Scale. The scale divides observed behavior into four categories, ranging from definitely positive to definitely negative. The Frankl method of the classification can be used for recording children's behavior in the dentist's office. Following is a description of the scale:

- *Rating 1: Definitely Negative.* Refusal of treatment, forceful crying, fearfulness, or any other overt evidence of extreme negativism.

- *Rating 2: Negative.* Children are reluctant to accept treatment and demonstrate some evidence of negative attitude but not pronounced. Slightly combative, verbal, slightly excited, able to be restrained and complete the procedure safely.

- *Rating 3: Positive.* The child accepts treatment but may be careful. The child is willing to comply with the dentist, but may have some reservations. Quiet, not combative, cooperative, nonverbal.

- *Rating 4: Definitely Positive.* This child has a good rapport with the dentist and is interested in the dental procedures. Happy, helpful.

One can identify those children displaying a positive behavior by jotting “+” or “++”. Conversely, uncooperative behavior can be noted by “-” or “--”.

Wright's clinical Classification places children in 3 categories: Cooperative, Lacking in cooperative ability and Potentially cooperative behavior.

1. *Cooperative* children are reasonably relaxed. They have minimal anxiety. They may be enthusiastic. They may laugh and enjoy the situation. They can be treated by straight forward behavior-shaping approach.

2. *Lacking in cooperative ability*. This category includes very young children (< 2.5) with whom communication cannot be established and comprehension cannot be expected. Because of their age, they lack cooperative ability. Another group of children with *Lack cooperative ability* is those with specific debilitating or handicapping conditions. The severity of the children's condition prohibits cooperation in the usual manner.

At time, special behavior guidance techniques are used for these children. Although their treatment is performed, immediate positive behavioral changes cannot be expected. Management is best accomplished through the use of sedation or general anesthesia.

3. The nomenclature applied to a *Potentially cooperative* child is a behavior problem. The category includes children aged three through teens and unable to express their fears and anxieties. Their behavior is essentially reflection of their inability to cope with their anxiety. Potentially cooperative patients show some specific reactions, such as timidity, whining or defiant behavior.

This type of behavior differs from that of children lacking cooperative ability because these children have the capability to perform cooperatively. This is an important distinction. When a child is characterized as potentially cooperative, clinical assessment is that the child's behavior can be modified; that is, the child can become cooperative. Potentially cooperative children require behavior modification procedures.

BEHAVIOR MANAGEMENT METHODS IN PEDIATRIC DENTISTRY

Behavior management of children in the dental practice can be achieved by two methods:

- I — Non-pharmacological methods;
- II — Pharmacological methods.

Behavior management is the means by which the dental team efficiently performs treatment of the child and at the same time installs a positive dental attitude.

Behavior shaping is that procedure which very slowly develops behavior by reinforcing successive approximations of the desired behavior until the desired behavior comes to be.

Dentist professional goals are to enhance communication, to be a partner of the child and parent to make a positive dental attitude and improve children's dental health.

Behavior Management Techniques. There are different methods to modify the behavior of the child. It is important to understand the theory of each method and its effects in behavior modification of the child to accept dental treatment.

Objectives of behavior modifications are:

- To establish effective communication with the child and the parent.
- To gain confidence of both the child and the parent and the acceptance of dental treatment.
- To teach the child and the parent, the positive aspects of preventive dental care.
- To provide a relaxing and comfortable environment for the dental team to work in, while treating the child.

Behavior management could be started even before the child actually comes for dental treatment to the clinic.

Preappointment Behavior Modification refers to anything that is said or done to influence the child's behavior positively before the child enters a dental clinic. The merit of this strategy is that it prepares the pediatric patient and eases the introduction to dentistry.

The *preappointment experience* means taking the child to the dentist's office for a tour and orientation. The child meets the receptionist, dental assistant and dentist. If this goes well, the child gets familiar with certain dental equipment. This removes any unfavorable imaginations about the dentist's office and its personnel for the child. It's received a great deal of attention because the first dental visit is crucial in the formation of the child's attitude toward dentistry.

Parent Counseling. This is a very important aspect to be considered. Advise the parents:

- never to use dentistry as punishment to the child;
- not to bribe their child to go to the dentist as this will mean to the child that there must be danger ahead;
- not to talk about their own fears of dentistry in front of their children;
- not to promise the child that the dentist will not hurt or what dentist is not going to do.

Parental influences (Child and Parent Separation Vs Parental Presence).

One of the great debates in pediatric dentistry centres on whether parents should be allowed in the dental surgery while their child is receiving treatment.

Parents' attitude to dental treatment has a profound influence on the child. Although parents must have an active and valued role in the child's oral health,

their presence in the dental surgery can pose a challenge for the dentist, especially if parents feel that they have to be involved in verbal communication with the child during treatment. There is no clear evidence that parents' presence in the dental surgery has any influence on the child's behavior. But a child's family, it could be argued, can offer emotional support during treatment.

The first issue that must be raised is whether dentists have the ethical/moral right to bar parents from sitting in with their children when dental care is being undertaken. Clearly, parents have views and anxiety levels may be raised if parents feel their familial rights are being threatened and a child may be stressed by tension between parents and the operator.

Wright et al. (1987) in their comprehensive book on child management summarize the advantages of keeping parents out of the surgery as follows:

- the parent often repeats orders, causing annoyance to both the dentist and the child patient;
- the parents intercept orders, becoming a barrier to the development of rapport between the dentist and the child;
- the dentist is unable to use voice intonation in the presence of the parent because he or she is offended;
- the child divides attention between the parent and the dentist;
- the dentist divides attention between the parent and the child;
- dentists are probably more relaxed and comfortable when the parent remains in the reception area.

The following circumstances for inclusion of the parent are now generally accepted by paediatric dentists:

- all pre-school children;
- children with physical, emotional or psychological impairments;
- children having an examination carried out (for consent purposes, especially for radiographs);
- when the parent and/or patient expressly wish for the parent to remain present.

Patients with special needs require a high degree of parental involvement in oral health care, particularly for those children with educational, behavioral and physical difficulties. For example, toothbrushing is a complex cognitive and motor task which will tax the skills of many handicapped children. A parent will have to be taught how to monitor the efficiency of the plaque removal and intervene when necessary, to ensure the mouth is cleaned adequately. Diet is also important, so clear advice must be offered and reinforcement planned at regular intervals.

There are limitations of Parental Presence based on: infection control, patient flow, or confidentiality. Parental Presence is irrelevant for conscious sedation and general anesthesia.

But at a minimum, parents should be encouraged to participate in examination if possible.

However, whether the parent stays in or out is a very much an individual decision based on the preference of the dentist, child and parent. In the end it is a personal decision taken by the dentist in the light of parental concerns and clinical experience.

NON-PHARMACOLOGICAL APPROACHES TO CHILDREN'S BEHAVIOR MANAGEMENT IN DENTISTRY

Common Non-Pharmacological Behavior management methods are:

- Communicative management;
- Reducing uncertainty (Tell Show Do);
- Modelling;
- Systematic Desensitization;
- Distraction;
- Voice Control;
- Contingency management;
- Aversive Conditioning

Communicative Management. The way a dentist interacts with patients will have a major influence on the success of any clinical or preventive care. Communicative Management is the most basic form of behavior management and is the first step in treating a child. The purpose is to develop relations with the patient and gain his trust.

Types of communication are verbal and non-verbal. Recommendations for communication with child are the following: try to call him or her by the nick name, give compliments and keep the patient occupied in your conversation throughout the procedure.

Dentistry has a highly specialized vocabulary and it is unlikely that many children, even adolescents, will understand our meaning if we rely on jargon. The key to successful communication is to pitch your advice and instructions at just the right level for different age groups of children. There is no universal approach to patients, so careful treatment planning and assessment are required before children or their parents are given specific written or verbal advice.

The language used should consist of words that express pleasure and friendship. Use questions that elicit any answer except Yes or No.

The use of fear promoting words like *Needle and injection* should be avoided. Explain the procedure briefly using euphemisms. They are the substitute words and are less provoking and essential for effective communication. The use of Euphemisms should be encouraged (Box 2).

Some “child-friendly” terms used to describe dental equipment and procedures

Dental equipment, procedures	Euphemisms
Rubber dam	“Rain coat”
Suction	“Hoover”
Slow speed hand piece	“Small brush”, “helicopter”, “Buzzy bee”
Air rotor / Drill machine	“Magic air/wind”, “Whizzy brush”, “tooth shower”, Mr Whistle Air spray,
Dental explorer	“Stick”
Excavator	“Spade”
Drilling	“Removing worms from the tooth”
Local anesthetic	“Jungle juice”, “sleepy juice”, “putting tooth to sleep”
Needle injection	“mosquito bite”

Non-verbal communication is the reinforcement and guidance of behavior through appropriate contact, posture, and facial expression. Non-verbal communication includes warm, friendly environment and happy smiling team. Non-verbal messages can be received from eye or body contact, for example placing a hand on a child’s shoulder while setting on a chair side, conveying a feeling of warmth and friendship. Objectives of non-verbal communication are the following:

- To enhance the effectiveness of other communicative management techniques.
- To gain or maintain the patient's attention and compliance.
- They may be used with any patient.

Reducing uncertainty (Tell-Show-Do — TSD). The majority of young children have very little idea of what dental treatment involves and this will raise anxiety levels. Most children will cope if given friendly reassurance from the dentist, but some patients will need a more structured program.

One such structured method is the Tell-Show-Do technique. This form is the basis for most behavior guidance strategies in the clinic. Knowingly or unknowingly most of us will use this technique in treating any child patient. This technique was described by Addelston in 1959. This technique of behavior shaping uses with both verbal and non-verbal communication and may be used with any patient.

Objectives:

- To teach the patient important aspects of the dental visit and familiarize the patient with the dental setting.
- To shape the patient’s response to procedures through desensitization and well described expectations.

A short explanation of the next step before introducing it prepares the child and improves the acceptance of the procedure. Some child-friendly

terms for description of dental procedures and equipment are shown in Box 2. As its name implies it centres on three phases:

“*Tell*” — Here the dentist first explains the procedure to the patient in easy terms and in a way appropriate for child’s understanding;

“*Show*” — Then the dentist slowly demonstrates the procedure to the patient, e.g. using a mirror and probe on a model;

“*Do*” — and continues with performing the procedure as described.

Another technique to reduce anxiety among very worried children is to send a letter home explaining all the details of the proposed first visit so that uncertainty will be reduced. The evidence for this approach is not clear-cut as parental anxiety is changed by pre-information rather than the child’s.

Modelling / Imitation. Modelling in simple terms refers to imitating behavior by observation. It was developed by Bandura (1969). He believed that “learning occurs only as a result of a direct experience, i.e. by witnessing the behavior and the outcome of that behavior for other people”.

It is a type of behavior modification in which young patient can gain dental experience by looking at other children receiving treatment as a live model or by watching a video tape of a child undergoing treatment.

This technique is considered to improve the behavior of the child in the dental environment and decreases anxiety by showing a positive outcome of the required procedure.

Types of models:

a) Live models: the other children in the clinic who are undergoing any dental treatment. The models should be of the same age and should exhibit appropriate behavior and be praised. The best live models are the siblings usually the elder brother or sister.

b) Filmed models: the model in this case is not present physically. We can have posters or small movies showing the famous cartoon characters like Mickey Mouse brushing his teeth or a famous movie star being friendly to a dentist and getting his treatment done. The children readily imitate this behavior.

Modelling is most beneficial when compared to other means for dentally uneducated child.

Cognitive approaches. Modelling helps people learn about dental treatment from watching others, but it does not take account of an individual’s “cognitions” or thoughts. People may heighten their anxiety by worrying more and more about a dental problem so creating a vicious reinforcing circle. Thus there has been great interest in trying to get individuals to identify and then alter their dysfunctional beliefs.

A number of cognitive modification techniques have been suggested, the most common ones are:

1) asking patients to identify and make a record of their negative thoughts;

2) helping patients to recognize their negative thoughts and suggesting more positive alternatives — “reality based”;

3) working with a therapist to identify and change the more deep-seated negative beliefs.

Cognitive therapy is useful for focused types of anxiety — hence its value in combating dental anxiety.

Another approach that could be considered a cognitive approach is distraction.

Distraction. Various types of activities can be used to distract the child’s attention. Showing appropriate movies, playing video games etc. can be useful. However, in the authors’ opinion, talking to the child throughout treatment is an effective method of achieving this aim.

This approach aims to shift the patient’s attention from the dental setting to some other situation, or from a potentially unpleasant procedure to some other action.

Dentists use distraction with words such as talking while administering local anesthesia or direct the patient’s attention through audio stories, music or cartoon. This technique is useful for all patients who can verbally communicate.

Voice Control. Voice control is a controlled variation of voice volume, tone, or pace (tempo) to influence and direct the patient’s behavior, for example, changing voice from soft to loud without any changes in the face expression.

Objectives:

- To gain the patient’s attention and compliance.
- To avert negative or avoidance behavior.
- To establish appropriate adult-child roles.

This technique can be used alone or with other methods. Indications: may be used with any patient.

Voice control is not appropriate for too young children who cannot understand or for children with intellectual or emotional impairment.

Relaxation. Relaxation training is of value where patients report high levels of tension, and consists of bringing about deep muscular relaxation. As the techniques require the presence of a trained therapist, the potential value in general pediatric dentistry has still to be assessed.

Contingency Management. Contingency Management is a method where a child’s behavior is changed by presenting or withdrawing a reinforce (anything which increases the possibility of desired behavior). It can be:

- Positive reinforcement. If a child’s particular behavior is encouraged by praise or by patting on his back, the possibility of same behavior being repeated increases.

- Negative reinforcement. Withdrawing a toy from the child on performance of an undesirable behavior.

Reinforcers can be of three types:

- Social Reinforcers include positive voice modulation, facial expression, verbal praise and etc. by all members of the dental team.

- Material: giving the children small gifts after the dental treatment has been done.

- Activity: the child can go and play in the garden with his friends after his treatment has been done.

Behavior modification strategies

Many children who are either too anxious, used to having their own way at home or harbor genuine phobia regarding various aspects of dental treatment, require more specialized approaches to management. For this reason, an understanding of the theories of learning and development is important and will help the dentist not only to provide the immediate care that the child requires but also help shape the child's positive attitude for future dental treatment.

Aversive Conditioning. It is a behavior modification that eliminates a child attempt to avoid dental treatment.

Aversive conditioning is a form of behavior therapy in which an aversive stimulus, which is an object or event that causes strong feelings of dislike or disgust, is paired with an undesirable behavior in order to reduce or eliminate that undesirable behavior. The purpose of aversive conditioning is to decrease or eliminate undesirable behaviors and it focuses on changing a specific behavior in order to bring out changes.

These techniques are used in management of non-cooperative children. This method is used as a last resort with the very young, immature or physically handicapped child or those who are mentally or emotionally affected. In such situations, both the type of behavior and the type of aversive stimulus used will influence the treatment that is being undertaken. In aversive conditioning negative reinforcement is deployed.

Aversive Conditioning techniques include Physical restraints and Hand over mouth exercise (HOME). Consent from the parents is necessary before using these procedures.

HOME (Hand over mouth exercise) (Levitas, 1974). The purpose of this technique is to gain the attention of a highly non-cooperative child so that communication can be achieved. It is a technique for managing unsuitable behavior that cannot be modified by straight forward technique. It is not a punishment and the dentist should not express anger using this method.

Use of the HOME technique is indicated for:

- Healthy child who is able to understand and cooperate, but who exhibits defiance or hysterical behavior during treatment.

- Children over the age of 3 years who can understand simple verbal communication.

Contraindications:

- The technique should not be used with frightened children.
- Also, it mustn't be used if children are too young to understand or they have physical or mental disabilities that prevent them from understanding.

Technique: The dentist gently but firmly places his hand over the child's mouth and the child is told that when he cooperates the hand will be removed. When the patient indicates his readiness to cooperate the hand is removed and the patient is reevaluated. The airway should never be closed.

Physical Restraints. It can range from gently holding the child's hands during the injection procedure to full body restraint. The parents must be informed that the technique is safe and effective and their consent must be obtained.

Objectives:

- To control movements and prevent self-injury.
- To teach the child that resistance is unnecessary and he is willing to cooperate.
- They should cause no injury to the patient and used only when necessary.

Indications: The method is used for patients who are not capable of understanding the dental procedure, some mentally or physically handicapped patients because they have difficulty to control movement of their arms and legs.

Types of Physical Restraint are active and passive. They may also be divided based on area of use:

- To control head movements ("Forearm-body support"; "Papoose broad head positioner"; "Plastic bowl");
- To control body movements (Safety belt; Triangular sheet; Pedi-wrap; Papoose board);
- To control the oral cavity: Intra-oral mouth prop (Wrapped tongue blades, Bite blocks) and Extra-oral mouth prop (Molt mouth prop which is constructed of metal and covered with rubber tubing).

Aversive conditioning and negative reinforcement are usually employed in situations where all other avenues to establish communication with the child have been exhausted. These approaches are not used again and again in the same child but on one occasion to establish communication, following which conventional techniques based on positive reinforcement are introduced.

Dental anxiety is managed by the traditional behavior guidance strategies, but the management of severe anxiety, and in particular, needle phobia requires special techniques, such as systematic desensitization.

Systematic Desensitization. This technique is based on the work of Joseph Wolpe (1952). This technique helps individuals with specific fears or phobias to overcome them by repeated contacts. It is a training or steps taken to reduce the sensitivity of the patient to a particular anxiety producing situation or object. Each situation or object is then introduced progressively starting from least stressful objects to the most stressful one.

Behavior shaping. It is based on Skinner's theory of operant conditioning and positive reinforcement is an important element of this technique. The dental procedure is introduced in small steps, the least anxiety provoking first, and upon acceptance positive reinforcement is provided to the child. A simple "well done", "your mum/dad are really proud of you" or "you are so brave/good" usually works well. Through a series of such approximations each followed by a positive reinforcement, the desired behavior is achieved. A reward, such as a sticker or a small soft toy at the end of a visit, provided the child has done well, is also an effective reinforcement. No reward should be made if the visit has not gone well, especially if the child has behaved badly, as this just reinforces bad behavior.

Decision Making Factors. The choice of behavior management techniques must be based on an evaluation that weighs risks versus benefits to the child.

The following considerations enter into the decision making:

- Urgency of care;
- Alternative methods, including referral;
- Need for cooperation;
- Skill of the Practitioner;
- Options available at each clinic;
- Expectations of the parents or caregiver;
- Emotional development of the child;
- Past medical history.

In the case when behavior management techniques are not effective, it is necessary to use Pharmacologic Behavior Management. Pharmacologic means of behavior management should be used only when the patients lack cooperative behavior or a systemic condition requires it.

PHARMACOLOGICAL MANAGEMENT OF PAIN AND ANXIETY IN CHILDREN

Pain in children is a public health concern of major significance in most parts of the world. Although the means and knowledge to relieve pain exists, children's pain is often not recognized, is ignored or even denied. These guidelines address the pharmacological management of persisting pain in children with medical illnesses.

WHO defines pain as “an unpleasant sensation that occurs due to the inevitable damage to the tissue”.

The International Association for the Study of Pain (IASP) defines pain as, “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage”. The definition emphasizes both the physical and emotional nature of pain. There is one more definition: “The inability to communicate verbally does not negate the possibility that an individual is experiencing pain and is in need of appropriate pain-relieving treatment. Pain is always subjective ...”.

Effective pain management of a child, especially an anxious one, is a challenge to every dentist. The need for good management of anxiety and pain in paediatric dentistry is of paramount importance. A common cause of complaint from parents and their children is that a dentist “hurt” unnecessarily. Such a complaint can jeopardize access to lifelong dental care.

Children are anatomically and physiologically different from adults. The anatomy of the airway means that breathing is through a narrower, more fixed “wind pipe”. Physiologically, a child is less capable of taking in a bigger volume of air even when urgently required. Coupled with this, both the demand for oxygen (consumption) and the incidence of periodic breathing and apnoeas are higher compared to adults. These differences mean that a child can become hypoxic more easily.

There is a strong relationship between the perception of pain experienced and the degree of anxiety perceived by the patient. Painful procedures cause fear and anxiety; fear and anxiety intensify pain. This circle of causes and effects is central to the management of all patients.

Children’s perception of pain. A child’s perception of pain is purely subjective and varies widely, particularly with age.

Infants up to about 2 years of age are unable to distinguish between pressure and pain.

After the age of approximately 2 and up to the age of 10, children begin to have some understanding of “hurt” and begin to distinguish it from pressure or “a heavy push”. The problem is that it is not always possible to identify which children are capable to explanation and who will respond by being co-operative when required with local anesthesia and dental treatment in the form of drilling or extractions.

Children over the age of 10 are much more likely to be able to think abstractly and participate more actively in the decision to use local anesthesia, sedation, or general anesthesia.

Actually, children’s response to pain is determined by age, memory of previous negative dental experience, and their coping ability influenced by family values, level of general anxiety, and intelligence.

Methods of pharmacological pain control are the following:

- Local analgesia and anesthesia;
- General anesthesia;
- Combined method (analgesia and sedation).

! The majority of dental procedures on children can be carried out using a combination of two techniques: behavior management and local anesthetic.

Medical status. Different methods of pain control vary from simple behavior management to full inhalation general anesthesia in a hospital operating theatre. The wide variety of medical problems makes it difficult to be precise about the management strategy appropriate for each patient.

The decision as to whether a patient should be treated under general anesthesia or local anesthesia, or local anesthesia with sedation depends on a combination of factors, the most important of which are:

- 1) the age of the child;
- 2) the degree of surgical trauma involved;
- 3) the perceived anxiety and how the patient may respond (or has responded) to similar levels of surgical trauma;
- 4) the complexity of the operative procedure;
- 5) the medical status of the child.

There are no hard and fast rules, and every procedure in every child must be assessed individually and the different elements considered in collaboration with the parent and, where appropriate, with the child.

Local anesthesia for children

Local anesthesia in dentistry are divided into:

- 1) non-injecting (chemical, physical);
- 2) injection (infiltration, regional block anesthesia, intraligamentary, papillary);
- 3) needle-free (ink-jet).

Physical non-injecting methods (non-pharmacological). A number of non-pharmacological methods for reducing the pain of operative dentistry are now available, including the use of electrical stimulation (electroanalgesia — TENS), radio waves (audioanalgesia), ultrasonic action and cooling (refrigeration). Hypnosis also belongs to this category. Hypnosis can be used as an adjunct to local anesthesia in children by decreasing the pulse rate and the incidence of crying. It appears to be most effective in young children.

Electroanalgesia or TENS (Transcutaneous Electrical Nerve Stimulation) has been shown to be very effective in providing anesthesia for restorative procedures in children aged 3–12 years. The technique has also been used to provide pain control during the extraction of primary teeth. It can also be used as a “deep topical” agent to reduce the pain of local anesthetic injections. In younger children the level of stimulation is controlled by the operator.

Children over 10 years can sufficiently understand the method to be able to control the level of stimulus themselves.

TENS blocks transmission of the acute pain of dental operative procedures is due to the fact that large myelinated nerve fibres (such as those responding to touch) have a lower threshold (limit) for electrical stimulation than smaller unmyelinated pain fibres. Stimulation of these fibres by the current from the TENS machine closes the “gate” to central transmission of the signal from the pain fibres.

In addition, if the patient operates the machine, the feeling of control can allay anxiety and aid in pain management.

Audioanalgesia (sound anesthesia) is based on the establishment in the audio analyzer area in the cerebral cortex focus excitation, which causes diffuse inhibition in other departments of brain. This is achieved by the impact on the auditory analyzer beep of a specific frequency.

Dental chairs are equipped with headphones which provide calming music, “white” noise (sound waves of different frequency and amplitude), like the sound of the waterfall, etc. Audioanalgesia can be successfully applied in interventions on the hard tissues of the tooth.

Cooling is a physical method in dentistry involved the use of ethyl chloride. Ethyl chloride is a volatile liquid which during evaporation reduce the temperature of the surface tissue to produce anesthesia. This method is rarely used in children as it is difficult to direct the stream of liquid accurately without involving associated sensitive structures such as teeth. In addition, the general anesthetic action of ethyl chloride should not be forgotten.

Non-pharmacological methods of pain control offer two advantages. First, systemic toxicity will not occur, and, second, the soft tissue anesthesia resolves at the end of the procedure. This reduces the chances of self-inflicted trauma.

Chemical non-injecting method (Surface/terminal, superficial, topical anesthesia). Indications for surface anesthesia in children are:

- pre injection treatment (the main use);
- anesthesia of the oral mucosa;
- anesthesia of dental hard tissues;
- analgesia of the tooth pulp;
- some intraoral procedures including the primary tooth extraction.

The success of topical anesthesia is technique dependent. Topical anesthetic agents will anesthetize a 2–3 mm depth of surface tissue when used properly. The following points are worth noting when using intraoral topical anesthetics:

1. The area of application should be dried.
2. The anesthetic should be applied over a limited area.
3. The anesthetic should be applied for sufficient time.

Topical anesthetics are sprays, solutions, creams, or ointments.

A number of different preparations varying in the active agent and in concentration are available for intraoral use. Medications for topical anesthesia are:

- Benzocaine: topical 20 % mucous membrane spray, 20 % mucous membrane gel and liquid; 20 % mucous membrane swab;
- Lidocaine (lignocaine): Oral gel, Topical ointment, Topical patch (lidocaine 5 %), Lidocaine cream, 10 % Topical aerosol spray;
- Pyromecainum: 1.2 % solution, 5.2 % ointment.

The agents most commonly used are lidocaine (lignocaine) and benzocaine.

Sprays are the least convenient as they are difficult to direct. Some sprays taste unpleasant and can lead to excess salivation if they inadvertently reach the tongue. In addition, unless a metered dose is delivered, the quantity of anesthetic used is poorly controlled. It is important to limit the amount of topical anesthetic used. The active agent is present in greater concentration in topical preparations compared with local anesthetic solutions and uptake from the mucosa is rapid. Systemic uptake is even quicker in damaged tissue.

How to use spray-anesthetic: ask the child to hold his breath for a short time to prevent a contact of the anesthetic with the mucous membrane of the respiratory tract. Spray is not recommended for children under 3 years. The contact of 10 % lidocaine spray with the respiratory tract in children can result in reflex respiratory arrest.

An effective method of application is to spread some cream on the end of a cotton bud. All the conventional intraoral topical anesthetics are equally effective when used on reflected mucosa. The length of time of administration is crucial for the success of topical anesthetics. Applications of around 15 s or so are useless. An application time of about 5 min is recommended. It is important that topical anesthetics are given sufficient time to work, because for many children this will be their initial experience of intraoral pain-control techniques. If the first method encountered is unsuccessful then confidence in the operator and his armamentarium will not be established. Although the main use of topical anesthetics is as a pre-injection treatment, these agents have been used in children as the sole means of anesthesia for some intra-oral procedures including the extraction of deciduous teeth.

Jet injectors belong to a category somewhere between topical and local anesthesia. These devices allow anesthesia of the surface and to a depth of over 1 cm without the use of a needle. They deliver a jet of solution through the tissue under high pressure. Conventional local anesthetic solutions are used in specialized syringes and have been successful in children with bleeding diathesis where deep injection is contraindicated.

Jet injection has been used both as the sole means of achieving local anesthesia and prior to conventional techniques. This method of anesthesia has

been used alone and in combination with sedation to allow the pain-free extraction of primary teeth.

The use of jet injection is not widespread for a number of reasons. Expensive equipment is required, soft tissue damage can be produced if a careless technique is employed, and the specialized syringes can be frightening to children both in appearance and in the sound produced during anesthetic delivery. In addition, the unpleasant taste of the anesthetic solution, which can accompany the use of this technique, can be off putting. Although no needle is employed the technique is not painless.

Controlled-release devices. The use of topically active agents incorporated into materials that will adhere to mucosa and allow the slow release of the agent is a potential growth area in the field of local anesthetic delivery. Such techniques might prove to be of value in pediatric dentistry. Clinical studies investigating the release of lidocaine (ligno-caine) from intra-oral patches have shown some promise.

Local anesthesia technique. Rules for local anesthesia technique in children are the following:

- Before (giving) local anesthesia informed consent must be obtained. This consent may be implied, verbal, or written. The main purpose of the written consent is to demonstrate post hoc, in the event of a dispute, that informed consent was obtained.

- Discuss the dental problem / discuss the treatment options / alternatives / agree to the treatment plan.

- Medical history should be carefully collected, including allergic and pharmacological status.

- All information must be registered in the dental medical card.

The proposed plan of treatment must indicate the nature and extent of the treatment and the approximate time of local anesthesia and/or sedation. There is no need to obtain written consent for each separate time when sedation is used. If the plan of treatment changes and along with it the frequency or nature of sedation, then it is prudent to obtain written consent for the change. The greater risks are associated with general anesthesia and it requires specific written consent for each occasion when the treatment is carried out under general anesthesia. It is necessary:

- To assess the patient's general condition.

To evaluate the nature, scope and duration of the dental treatment.

Based on the assessment of the overall condition of the patient and the characteristics of the dental treatment we should choose the type of anesthesia, the anesthetic, the amount of anesthetic solution.

- To know the anatomic and topographic features of the area, where anesthetic will be administered.

- Before anesthesia oral cavity should be disinfected with an antiseptic.

- To assess the patient's condition after anesthesia (general, local signs).

Infiltration anesthesia. Infiltration anesthesia is analgesia of peripheral nerve fibers and their endings. This type of anesthesia is most often used, and works better in children because the alveolar bone surrounding the primary and erupting permanent teeth has a distinct, but thin, lamina dura; alveolar bone has larger marrow spaces, greater vascularity, and fewer trabeculae than adult tissues have. So anesthetic is rapidly absorbed into the bloodstream and therefore quickly manifested as a pain reliever, as well as toxic effects of the drug.

Infiltration anesthesia is the method of choice in the maxilla. The infiltration of 0.05–0.1 ml of local anesthetic is sufficient for pulpal anesthesia of most teeth in children. The objective is to deposit local anesthetic solution as close as possible to the apex of the tooth of interest.

Features of infiltration anesthesia techniques in children are:

- to tell the child about the upcoming feeling of pressure and a little discomfort before the anesthesia;
- to show the syringe in a safe perspective (hiding the needle);
- to convey the syringe out of sight of the child's eyes;
- to distract the child from the terrible object.

For better adaptation of the child to the procedures of local anesthesia, treatment begins with the upper quadrant. This is the region that is most easily anesthetized with the least discomfort.

Needles should be sharp, short and narrow (30G or 27G). Narrow needles are more likely to penetrate blood vessels than their wider counterparts.

The choice of syringe used for conventional local anesthetic injections in children must allow aspiration both before and during injection.

Anesthetic should not be cold: cartridges stored in a refrigerator should be allowed to reach room temperature before being used.

During injection of anesthetic the dentist should distract the patient — stretching the mucosa and gentle pressure on the lip between finger and thumb can achieve this.

You must enter a small amount of anesthetic immediately after the beginning of the injection that will provide further manipulation painless because the penetration of the needle and administration of the anesthetic into the dense tissue in children is painful. Direct deposition under periosteum can be painful, therefore the solution is delivered supra-periosteally.

One aspect of local anesthetic delivery that can contribute to discomfort is the speed of injection: anesthetic should be administered slowly, at a rate of not more than 1 ml every 15–20 sec (1.8 ml anesthetic contained in the cartridge is administered for 45 ± 10 seconds).

Computerized delivery systems. The use of computerized delivery systems permits a very slow delivery of the solution. This is particularly useful when

injecting into tissue of low compliance such as the palatal mucosa and periodontal ligament. The computer system software installation allows automatically perform the aspiration test and monitor the progress of the anesthetic in the soft tissues.

Regional block anesthesia is anesthesia of the nerve trunk. Mandibular and maxillary *block anesthesia*, mental and incisive nerve block are examples of regional block anesthesia.

Inferior alveolar nerve block injections can be uncomfortable, but infiltration anesthesia is not successful in the posterior permanent dentition. Alternatively, intraligamentary injections may be employed to anesthetize the posterior mandibular teeth. Mandibular anesthesia is used most often. It is applied for children under 10 years if other methods are not effective.

In children, the mandibular foramen is low in relation to the occlusal plane. Thus in children it is easier to ensure that the solution is deposited around the nerve before it enters the mandibular canal. The technique of administration is identical to that used in adults and is best performed with the child's mouth fully open. The direct approach — when the needle is introduced from the primary molars of the opposite side — is recommended as less needle movement is required after tissue penetration with this method compared to the indirect technique. The height of insertion is about 5 mm above the mandibular occlusal plane, although in young children entry at the height of the occlusal plane should also be successful.

Intraligamentary anesthesia is a method of intraosseous injection with local anesthetic reaching the cancellous space in the bone via the periodontal ligament. This method allows the use of small amounts of local anesthetic solution. The recommended dose per root is 0.2 ml. The technique involves inserting the needle at an angle of approximately 30° to the long axis of the tooth into the gingival sulcus at the mesiobuccal aspect of each root and advancing the needle until firm resistance is met. Sensible dose limitations must be used, as entry into the circulation of intra-osseously administered drugs is as rapid as by the intravenous route. The technique is equally effective with conventional dental syringes.

Pulpal anesthesia is the action of anesthetic directly on the pulp receptors.

Interseptal anesthesia is an administration of anesthetic directly into the papilla (local anesthetic is delivered via the buccal papilla).

The choice of anesthetic for injection anesthesia. A number of local anesthetic solutions are now available that can provide anesthesia lasting from 10 min to over 6 h. There are few, if any, indications for the use of the so-called “long-acting” agents in children. The gold standard is lidocaine (lignocaine) with epinephrine (adrenaline). “Short-acting” agents such as plain lidocaine are seldom employed as the sole agent because, although pulpal anesthesia may be short-lived, soft tissue effects can still last over an hour or so. More

importantly, the efficacy of plain solutions is much less than those containing a vasoconstrictor.

Anesthetic with vasoconstrictor (epinephrine) is not used in children younger than 5 years, as well as in children with diseases of the cardiovascular system, endocrine disorders (diabetes, hyperthyroidism), bronchial asthma, severe somatic diseases. After the age of 5 the anesthetic can be used with vasoconstrictor at the concentration of 1 : 200 000 or less.

The following formula can be used for exact determination of a dose of anesthetic:

$$K = (2 \times \text{age} + \text{weight}) \%$$

where K is the percentage of the anesthetic dose administered to a child from the adult dose (%).

Complications of local anesthesia. Most common complications of local anesthesia are allergy, toxicity, cardiovascular effects.

Allergy to local anesthetics is a very rare occurrence, especially to the amide group to which most of the commonly used dental local anesthetics belong (such as lidocaine (lignocaine) prilocaine, mepivacaine and articaine). Allergy to other constituents of local anesthetic cartridges may occur, for example, metabisulfite a reducing agent which prevents oxidation of epinephrine.

Allergy can manifest in a variety of forms ranging from a minor localized reaction to the medical emergency of anaphylactic shock. If there is any suggestion that a child is allergic to a local anesthetic they should be referred for allergy testing to the local dermatology or clinical pharmacology department. Such testing will confirm or refute the diagnosis, and in addition should determine which alternative local anesthetic can safely be used on the child.

Toxicity. Overdosage of local anesthetics leading to toxicity is rarely a problem in adults but can readily occur in children. Children over 6 months of age absorb local anesthetics more rapidly than adults; however, this is balanced by the fact that children have a relatively larger volume of distribution and elimination is also rapid due to a relatively large liver.

Nevertheless, doses which are well below toxic levels in adults can produce problems in children. As with all drugs dosages should be related to body weight.

Treatment of toxicity. The best treatment of toxicity is prevention.

Prevention is provided by:

- 1) aspiration;
- 2) slow injection;
- 3) dose limitation.

In case of a toxic reaction the procedure is:

- 1) Stop the dental treatment.

- 2) Provide basic life support.
- 3) Call for medical assistance.
- 4) Protect the patient from any injury.
- 5) Monitor vital signs.

Cardiovascular effects caused by the injection of a dental local anesthetic solution are due to the combined action of the anesthetic agent and the vasoconstrictor. Local anesthetics affect the cardiovascular system by their direct action on cardiac tissue and the peripheral vasculature. They also act indirectly via inhibition of the autonomic nerves that regulate cardiac and peripheral vascular function.

Localized complications of local anesthesia include pain, motor nerve paralysis, failure of local anesthesia, long-lasting anesthesia and haematoma formation.

Pain resulting from local anesthetic injections can occur at the time of the injection due to the needle penetrating mucosa, too rapid injection, or injection into an inappropriate site (intraepithelial; subperiosteal; into the nerve trunk; intravascular).

Paralysis of the facial nerve can occur following deposition of local anesthetic solution within the substance of the parotid gland due to malpositioning the needle during inferior alveolar nerve block injections.

Failure of local anesthesia can be due to a number of causes including anatomy; pathology; operator technique.

The presence of acute infection interferes with the action of local anesthetics. This is partly due to the reduction in tissue pH decreasing the number of local anesthetic molecules. More importantly, nerve endings stimulated by the presence of acute infection are hyperalgesic.

Long-lasting anesthesia can result from direct trauma to a nerve trunk from the needle, injection of solution into the nerve, or occasionally from the use of more concentrated anesthetic solutions.

Haematoma formation. Penetration of a blood vessel can occur during local anesthetic administration.

The most common complication of the local anesthesia is a *self-inflicted trauma*. The most common site is the lower lip, but the tongue and upper lip can also be affected. It can be prevented by adequate explanation to the patient and parent. Give recommendations to parents about the need to control the baby to prevent biting of the soft tissue (lips and cheeks) after anesthesia.

Contraindications for local anesthesia. In certain children some local anesthetic materials are contraindicated, in others specific techniques are not recommended. Contraindications are divided into general and specific.

General contraindications are the following:

Immaturity. Very young children are not suited to treatment under local anesthesia as they will not provide the degree of cooperation required for

completion of treatment. A child who cannot differentiate between painful and non-painful stimuli (such as pressure) is unsuitable for treatment under local anesthesia.

Mental or physical handicap. Local anesthesia is contraindicated where the degree of handicap prevents cooperation.

Treatment factors. Certain factors related to the proposed treatment may contraindicate the use of local anesthesia. These factors include duration and access. Prolonged treatment sessions, especially if some discomfort may be produced such as during surgical procedures, cannot satisfactorily be completed under local anesthesia. It is unreasonable to expect a child to cooperate for more than 30–40 min under such circumstances even when sedated.

Acute infection. As mentioned above, acute infection reduces the efficacy of local anesthetic solutions.

Specific contraindications are the following:

Allergy. Allergy to a specific agent or group of agents is an absolute contraindication to the use of that local anesthetic. Cartridges containing latex in their bung must be avoided in those who are allergic to this material.

Medical conditions. Some medical conditions present relative contraindications to the use of some agents. For example, in liver disease the dose of amide local anesthetics should be reduced. Ester local anesthetics should be avoided in children who have a deficiency of the enzyme pseudocholinesterase.

Poor blood supply. The use of vasoconstrictor-containing local anesthetic solutions should be avoided in areas where the blood supply has been compromised, for example after therapeutic irradiation.

Specific techniques of injection anesthesia may be needed in some conditions.

Bleeding diatheses. Injection into deep tissues should be avoided in patients with bleeding diatheses such as haemophilia. Inferior alveolar nerve block techniques should not be used unless appropriate prophylaxis has been provided (e.g. Factor VIII for those with haemophilia). This can be overcome by the use of intraligamentary injections in the mandible in such patients for restorative dentistry.

Susceptibility to endocarditis. Intraligamentary anesthesia will produce a bacteraemia. In patients susceptible to endocarditis this method should not be used for procedures in which gingival manipulation would not normally be done. It is unreasonable to provide antibiotic prophylaxis before the intraligamentary anesthesia when other methods of local anesthesia can be used. When antibiotic prophylaxis has been conducted to cover the operative procedure then intraligamentary injections can be given.

Incomplete root formation. The use of intraligamentary techniques for restorative procedures on permanent teeth with poorly formed roots could lead to avulsion of the tooth if inappropriate force is applied during the injection.

Epilepsy. As seizure disorders can be triggered by pulsing stimuli (such as pulses of light) it is perhaps unwise to use electroanalgesia in children with epilepsy.

Each child features should be assessed and an appropriate method of pain control should be used. The vast majority of children are amenable to satisfactory treatment using behavior management and local anesthesia.

Conscious sedation techniques

Conscious sedation is defined as a technique in which the use of a drug or drugs produces a state of depression of the central nervous system enabling treatment to be carried out, but during which verbal contact with the patient is maintained throughout the period of sedation.

Sedation dentistry refers to the use of pharmacological agents to calm and relax a patient prior to and during a dental appointment. The drugs and techniques used to provide conscious sedation for dental treatment should carry a margin of safety wide enough to render unintended loss of consciousness unlikely.

The goal of conscious sedation is to use a pharmacological agent to increase behavioral management, to decrease anxiety levels and to calm and relax a patient prior to and during a dental appointment.

The level of sedation must be such that the patient remains conscious, retains protective reflexes, and is able to understand and respond to verbal commands.

Sedation by pharmacologic methods may be obtained by two general routes.

Enteral route is the absorption of medication through mucosal membranes of the alimentary canal. It includes medications that are either swallowed and absorbed through the mucosa (transmucosal — nasal, rectal, sublingual).

Parenteral route of sedative drug administration doesn't involve the alimentary tract. They are intravenous, inhalation, intramuscular, and submucosal administration, among others.

Inhalation sedation: Oxygen-nitrous oxide gas mixture in relatively low concentrations, usually 20–50 % nitrous oxide, is used in inhalation sedation.

The correct level of clinical sedation with nitrous oxide. One of the problems of the inexperienced clinician is to determine whether or not the patient is adequately sedated for the treatment to start. By careful attention to signs and symptoms experienced by the patient the dentist will soon be able to decide whether the patient is ready for the treatment. The very rapid uptake

and elimination of nitrous oxide requires the operator to be acutely vigilant so that the patient does not become sedated too rapidly.

The objective signs showing the patient is ready for treatment are: 1) the patient is awake; 2) the patient is relaxed and comfortable; 3) the patient responds coherently to verbal instructions; 4) pulse rate is normal; 5) blood pressure is normal; 6) respiration is normal; 7) skin color is normal; 8) pupils are normal and contract normally if the light is shone into them; 9) the laryngeal reflex is normal; 10) the gag reflex is reduced; 11) reaction to painful stimuli is lessened; 12) there is a general reduction in spontaneous movements; 13) the mouth is maintained open on request.

Subjective symptoms experienced by the patient are: 1) mental and physical relaxation; 2) a tingling sensation (paraesthesia) only or in any combination of lips, fingers, toes, or over the whole body; 3) mild intoxication and euphoria; 4) lethargy; 5) a sense of detachment, sometimes interpreted as a floating or drifting sensation; 6) a feeling of warmth; 7) indifference to surroundings and the passage of time; 8) dreaming; 9) lessened awareness of pain.

If the patient tends to communicate less and less, and is allowing the mouth to close, then these are signs that the patient is becoming too deeply sedated. The concentration of nitrous oxide should be reduced by 10 or 15 % to prevent the patient moving into a state of total analgesia.

Oral sedation. For oral sedation the pharmacological agents usually belong to a class of drugs called sedatives, which exert their action by depressing the central nervous system are used:

- tranquilizers (benzodiazepine) — Diazepam, Midazolam (Dormicum);
- other oral sedative drugs include: hydroxyzine hydrochloride and promethazine hydrochloride (psychosedatives with an antihistaminic, antiemetic, and antispasmodic effect), and ketamine.

There are many intravenous agents, but for dental purposes the practical choice is between midazolam and propofol. Propofol leads to rapid sedation and rapid recovery. Unfortunately, the risk of unintended loss of consciousness is high in this case because of the narrow therapeutic range of the drug that leads to anesthesia quickly. Therefore, propofol is used only in the presence of an anesthetist.

Midazolam is benzodiazepine that is more commonly used for paediatric dental sedation. It is water soluble and well tolerated by tissues, it is important to remember that some midazolam inadvertently becomes deposited outside rather than inside a vein. The liquid tastes bitter and so the preparation is often mixed with a fruit flavoured drink.

The onset of the sedative effects is variable and depends on the individual's rate of gastro-intestinal absorption, which can be affected by the rate of gastric clearance, the amount of food in the stomach, and even the time of the day. In addition, the dosage is determined by the body weight.

Despite this, some children may spit out the drug, leaving the clinician uncertain about the exact dosage that was administered.

When the treatment is complete, allow the patient to recover in the quiet room until he is ready to return home.

All these *criteria* are evidence of *conscious sedation*:

- the patient's eyes open;
- the patient's ability to respond verbally to questions;
- the patient's ability to maintain an open mouth independently;
- the patient's ability to maintain a patent airway independently;
- the patient's ability to swallow;
- a normal pink color.

Sedation dentistry has become very popular because it offers several benefits for both the patient and the dentist. Dental sedation can offer patient relaxation, increased comfort, movement control, patient co-operation, control of gag reflex, lessened reaction to painful stimuli, little or no memory of treatment, time saving: fewer appointments needed.

For some patient groups, the use of sedation dentistry is actually the only way that they can get the dental care they need and improve their dental health.

General anesthesia in pediatric dentistry

The use of general anesthesia in pediatric dentistry has a wide application, usually for the extraction of teeth. Fortunately, referrals have reduced, due to both the reduction in dental diseases and to the use of sedation. Nevertheless, there will always be a need for general anesthesia in dentistry, especially for pre-co-operative children.

The state of anesthesia is defined as: "The absence of sensation artificially induced by the administration of gasses or the injection of drugs or a combination of both". General anesthesia for the dental treatment requires the presence of an anesthetist. There are four stages of anesthesia: analgesia, excitement, surgical anesthesia, medullary paralysis.

The important feature of general anesthesia is that the patient can't independently maintain physiological function, such as breathing and protective reflexes.

Child examination before general anesthesia includes: complete blood count (clotting and blood platelets); blood group and rhesus; blood chemistry; general urine test; fecal test for helminth eggs; electrocardiogram; pediatrician opinion; conclusion of experts in the presence of comorbidities.

There are different types of general anesthesia, depending on the complexity and length of time for the planned dental procedure. In dentistry, anesthesia is classified into three main groups:

1) out-patient short-case "dental chair" anesthesia traditionally with a nose mask;

- 2) out-patient/day-stay “intubation” anesthesia;
- 3) in-patient/hospital-stay “intubation” anesthesia.

According to method of administration general anesthesia may be of two types: inhalation and non-inhalation.

Inhalation general anesthesia is narcosis, wherein anesthetics in a gaseous or vapor form are introduced into the respiratory system. Anesthetists can be delivered via inhalation through an anesthesia mask, laryngeal mask airway or tracheal tube. Types of inhalation are mask, nasopharyngeal and endotracheal anesthesia (through nose, mouth or tracheostomy).

Inhalation anesthetics are fluorotane, halothane, pentran, oxygen-nitrous oxide mixture, galan, etc. In pediatric dentistry fluorotane (halothane) — nitrous oxide — oxygen mixture is most often used.

Inhalation anesthesia is easily controlled, which is an advantage: children quickly fall asleep and quickly wake up after narcosis. However anesthetic masks complicate operations in the maxillofacial area and oral cavity. In addition, the mask and nasopharyngeal narcosis can result in asphyxia. Endotracheal anesthesia is used to prevent it and perform the most traumatic operations. It is the main kind of anesthesia in hospitals, the safest for the patient and comfortable to the surgeon.

Non-inhalation general anesthesia is caused by general anesthetics introduced into the body by a non-inhalation way.

It is often used in short operations. The anesthesia starts in 4–6 minutes and lasts for 1 hour. Types of non-inhalation general anesthesia are the following: intravenous, intramuscular and intrarectal. Intravenous anesthesia as an independent method is most often used in children. Non-inhalation anesthetics include sodium thiopental, hexenal, sodium hydroxybutyrate, propofol, sombrevine, ketamine and etc. Advantages of non-inhalation anesthesia are availability, simplicity and free access to the oral cavity. The disadvantages are the following: bad controllability and risk of asphyxia.

Pharmacological preparation for general anesthesia and surgical operation is called ***premedication***. It aims at creation of emotional comfort; facilitation of anesthesia administration; decreasing the dose of the drug; prevention of reflex reaction and decreasing the salivary glands secretion.

On this basis, premedication drugs are the following: sleeping pills (phenobarbital or other barbiturates); antihistamines (diphenhydramine, suprastin); analgetics (promedol, analgin); tranquilizers (seduxen, elenium) and atropine.

Absolute indications for general anesthesia:

- local anesthetics intolerance (allergy);
- uncontrolled fear.

The relative indications for general anesthesia:

- the presence of associated malformations and diseases of the central nervous system;
- the presence of diseases of the cardiovascular and respiratory systems (congenital and acquired heart diseases, asthma and others.);
- inflammatory processes of the maxillofacial region (abscess, osteomyelitis, etc.);
- complexity of procedure (children need one-stage treatment and removal of a large number of teeth);
- the child is pre-cooperative (too young to cope).

Contraindications for general anesthesia:

- acute diseases of the upper respiratory tract;
- diseases of the cardiovascular system in the stage of decompensation;
- exacerbation of chronic somatic diseases;
- uncompensated diabetes mellitus;
- severe rickets;
- full stomach;
- hyperthermia.

Summary:

1. Most patients can be treated using local anesthesia and proper behavior management.
2. A significant minority of patients will require some form of sedation to enable them to undergo dental treatment.
3. A small minority of patients require general anesthesia.
4. All techniques require careful and systematic assessment of the patient before being used.
5. Dentists and their staff require careful training and regular updates in the techniques of anesthesia and sedation for children

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