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Multi-sensory integration for strategic behavior guidance in pediatric dentistry: A narrative review

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Highlights

- This phenomenon can be used in clinical practice to create a novel communication medium between the clinician and the child.
- A sensory-adapted dental environment (SDE) may be suitable for reducing dental anxiety & maladaptive behaviors, thus facilitating a calming effect in the dental clinic among children.
- This approach to behavior guidance can be used to the child's advantage and to support the clinician in best managing the patient.

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Abstract

Dental procedures, especially invasive ones, can elicit fear and anxiety. Young children are especially prone to dental anxiety as they lack the necessary coping skills. Under such circumstances, communication management and the proper use of commands are universally considered beneficial. In this narrative review, we present a compendium of communication strategies by engaging multi-modal sense of a child in a dental operatory. Incorporatingthe visual, auditory, read &/write & kinesthetic-tactile (VARK) models in behavior guidance during dental treatment can ensure that the child has a positive dental experience. Further amplification of this model is done by incorporating it into a multi-sensory adapted dental environment. The sensory-adapted milieu can create a positive psychological impact while the dental treatment is in progress, thereby comforting the child.

Keywords: Behavior Guidance; Child Behavior; Communication; Dental Anxiety; Multisensory; Psychological Adaptation

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INTRODUCTION

A pediatric dentist should effectively analyze a child's developmental level, dental attitudes, and temperament to predict the child's reaction to treatment. Traditional oral healthcare delivery is plagued by dental fear. Pain directly impacts anxiety and, consequently, a child's behavior. Furthermore, additional circumstances, such as a previous unpleasant or painful dental experience or parenting methods, can also contribute to a child's noncompliance during a dental visit.[1] As a result, communication management and the appropriate use of commands are unanimously regarded as beneficial in pediatric dentistry.[2]

When there is a continuous engagement between the dentist and the patient, oriented toward communication and education, while also guaranteeing the safety of both oral health professionals and the kid throughout the delivery of medically essential care, the term Behavior Guidance is employed.[3] Various strategies in behavior management incorporating sensory aspects have been put into practice over the years and in contemporary dentistry, sensory-integrated approach is finding its place prominently (Table 1).[4-6] Because children's physical, intellectual, emotional, and social development is so diverse, along with a wide range of attitudes and temperaments, dentists have to be able to perform a range of behavior guidance techniques to meet every child's needs, as well as be tolerant and flexible in their implementation.[7] It is a complete, ongoing approach for developing and fostering the relationship between the child patient and the pediatric dentist, rather than applying particular strategies intended for interacting with children.[8]

The need to integrate several approaches into a broader behavior guidance strategy unique to each child thus should be considered. The dentist can attempt to construct a multi-sensory integration approach based on sensory and perceptual processes in children. Sensory integration is the brain's ability to organize the information received from the senses to form an appropriate response.[9] Multiple strategies, including oral communication, pictorial representation of the situation, and combining visual and auditory senses, ultimately lead to receiving information by the child through the pedagogic principles of extra information processing.[2]

In 1995, Hannaford made an excellent case for the sensory integration model for children with learning disorders. Carpenter et al.[15] further elaborated this module by integrating the neural mechanisms, sensory & motor functions it performs, and behavior. Lisle et al.[16] used the Visual, Auditory and Kinesthetic (VAK) models and other modalities to enhance the skills of children. Multi-sensory approach is essentially the processing of subject matter through integrating two or more senses. This approach may combine visual, auditory, tactile-kinesthetic and even read & write.[17] The need to merge &organize the information received from every sense into one cohesive mental picture of the natural environment can be considered sensory integration. The field was established by Ayres' in 1972 during a study on sensory integration and the child. In his model, Ayres described vestibular, proprioceptive and tactile as the primary level of the sensory integration model. This model can be incorporated either into communication or an adapted environment for effective behavior management.[18]

Verbal communication is crucial between the pediatric dentist and the child patient. While treating a child, dentists employ many linguistic approaches, each of which has a distinct impact on behavior and compliance. In 1960, Berlo[9] explained four essential components of communication - 1) Sender; 2) Message; 3) Context in which the message is sent; 4) Receiver.

Table 1. Changes in guidelines related to sensory behavior guidance

Year /authors	Changes/Additions	Reason/Remarks
AAPD 1990[4]	The value of psychological techniques in behavior management was discussed. Management using verbal reprimand, non- contingent prize & distraction with contingent rewards was used for behavior guidance. Other techniques used were filmed modeling & relaxation.	Parents had reported significant preference for non-invasive reinforcement techniques for behavior guidance over sedation, restraint & hand-over-mouth. Exposure to, and acceptance of, such safe management technique was yet to be discovered. Thus, behavior guidance based on sensory principles was not yet introduced.
EAPD 2006[5]	Emphasis on cognitive behavior therapy was done, which aimed at modifying both behavior and cognition. Communication skills for parent-child dyads were introduced in the form of verbal & non-verbal techniques.	Verbal communication such as questioning, listening, and explaining & non-verbal communication such as body language, eye contact, pitch, tone, speed of speech filled pauses were discussed. However, the use of sensory communication & environment strategies was not introduced.
AAPD 2008[6]	The 4 "essential ingredients" of communication (sender, message, context, and receiver) were introduced alongside with traditional behavior guidance techniques.	This is an extension of the overall behavior guidance continuum, with the intent to facilitate the goals of communication, cooperation, and delivery of quality oral health care for difficult patients.
AAPD 2021[3]	Communicative guidance formed a part of the behavior guidance technique. Associated with this process, other specific methods of pre-visit imagery, direct observation, tell-show-do, ask-tell-ask, voice control, nonverbal communication, and positive reinforcement were also included. Advanced behavior guidance using sensory-adapted environment was introduced.	Communicative guidance comprises a host of specific techniques that, when integrated, enhanced the evolution of a cooperative patient. Moreover, the sensory-adapted dental environment was found to enhance relaxation and avert negative behavior

Both sides must be able to exchange information and understand one other for communication to be successful. Communication fails when the flow of information is not communicated effectively. Thus, developing a sensory connection with the child patient is perhaps the first step in this model.[9] The dentist can correlate treatment information with visual and auditory sensations, and later, the combinations of tactile sensory techniques can also be integrated. Expanding sensory images is the next step, and it can be done by providing simulation and role-play techniques. Applying euphemism, analogies, and information through drawings and storybooks develops the child's mental image of their environment.[10]

While communication is vital for the success of dental treatment, the environment in which the child is being treated can also contribute to a holistic method for managing a child's behavior in

a dental operatory. The sensory environment is hypothesized to cushion and protect the individual from harsh stimuli by lowering unsettling visual, auditory, and tactile intensity while enabling calming responses.[12]

Some of the behavior guiding strategies mentioned in this review are built to maintain open communication lines, while others aim to break down communication barriers.

Studies by various authors and their observation on sensory approaches in behavior guidance has been published and been practiced in various forms (Table 2). However, incorporating these senses into behavior guidance should be strategic as per the age and cognition level of the child (Figure 1).

Table 2. Review of previous literature of sensory-approach in behavior guidance

Author & Year	Important Observations
Berson R, 1980[9]	Effective communication with a child has been evolving over the years and complex vocabularies have been developed. The authors of this study attempted to present a state-of-the-art of euphemistic language in pediatric dental practice.
Sarnat H, 2001[10]	Improving verbal conversational skills, emphasizing specific strategies, and improving linguistic abilities will contribute to better communication between children, and pediatric dentist and to better cooperation and success in treatment.
Driessnack, 2006[11]	The authors suggested that children's draw-and-tell conversations provide new insight into how children describe and experience fear and highlight the unique nature of information accessed while using this approach.
Shapiro M, 2007[12]	Various means of sensory-adapted behavior guidance strategies were introduced which helped the clinician in achieving better patient compliance.
Kumar SP, 2016[13]	Multi-sensory integration Approach Model based on sensory process and perceptual process. This model develops stimulation, sensation, Attention, Perception, Imagery, conceptualization and memory.
Sharma S, 2021[14]	Rationalizing reading can be an intelligent initiative toward the development of good oral habits and transforming the outlook of the oral healthcare system in years to come.

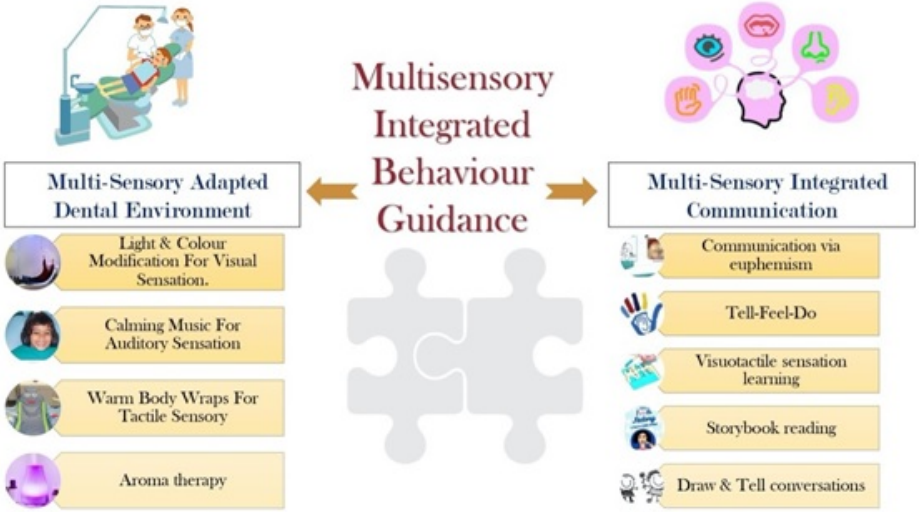

Figure 1. Multi-sensory integrated behavior guidance modalities

Multi-sensory Approach Integrated into Communication

Storybook reading

Researchers have used various educational and behavioral preparation aids such as visual pedagogy, tablets and computer applications, and social stories in the present era. Nevertheless, self-designed books and picture series can also be used to describe a situation and are designed to prepare a child for a dental procedure. In a study by Deshpande et al.[19], a self-designed storybook was given to children before receiving dental treatment (Figure 2). It was categorized based on oral conditions, diagnostic and investigatory procedures, and therapeutic and preventive procedures. The operator performed oral prophylaxis for participants on the first visit, and restoration procedures were performed on the second visit in the absence of parents. The anxiety was measured on the Facial Image Scale(FIS) and was found to be lower when compared to children who received dental treatment without this modified 'Tell-Read-Do' approach.

Self-designed storybook can be incorporated as an effective tool in behavior guidance as it is relatively simple & economical.[14] It also helped facilitate better knowledge and motivate patients to start caring for their oral health, ensuring a better, cavity-free future. Patients and their parents expressed positive opinions regarding using self-designed storybooks in the dental environment.

Figure 2. Storybook reading while receiving dental treatment

Euphemism

Effective communication with children has evolved, as have many other dental practices, and simplified vocabularies have been constructed. Euphemisms or second language (mild expressions that substitute for words that may be offensive or suggest unpleasantness) often make a dental procedure more acceptable to a patient.[20] The age of the patient should dictate their use in dental practice.Kozlov et al.[21] proposed that dentists limit using phrases that may cause a sense of despair in children because many suggestive fears are caused by the fear-inducing connotation of a word rather than the treatment itself. When working with a child patient, he advised avoiding deception instead of using descriptive words without the connotation of pain whenever possible. These euphemisms (favorable terms that replace words that may be unpleasant or convey displeasure) can better help a patient accept a dental procedure. In a study by Deshpande et al.[22], the dentist displayed visual flash cards to children before receiving dental treatment (Figure 3). The flashcards were designed by giving dental instruments and terminologies a euphemistic approach. This method aided in acclimatizing the child to a dental operatory. Anxiety measured on the Facial Image Scale (FIS) was found to be lower when compared to children who received dental treatment without using this approach.

Figure 3. Behavior guidance by using pictorial flashcards

Draw and tell conversations

In psychiatry, psychology, and education, children's drawings have a long history.[23] Although children's drawings rarely display the level of talent seen by mature artists, they frequently provide form and meaning to familiar and unusual situations encountered at home, school, and on the street.[24] Young children often know more than their verbal reports indicate, and the brevity of their responses may reflect their incapacity to retrieve knowledge rather than their comprehension of the event or topic in question.

The use of drawings expands the number of information children share.[11]It might establish a code of conduct with the child to make their dental process meaningful, relevant, and orienting (Figure 4). Fear can unmake a child's world. Listening to the description of the drawing can help us get a sense of control in connection to it.[25]

Figure 4. A child responding through draw and tell conversation

Tell-Play-Do

This technique involves the verbal explanations of procedures in the way the child can understand (tell); presentation of the visual, auditory, olfactory and touching aspects of the process without threatening (show) and then without deviating from explanation and demonstration, the procedure has to be done (do) (Figure 5A-D). A study by Farhat-McHayleh N et al.[26] showed that children who received live modeling had a lower fear perception range as measured on the Facial Image Scale. Tell-Play- Do can significantly influence younger children by making modest changes, making them feel more at ease and receiving dental treatment.[27]

Audio-tactile Performance Technique

Children with special healthcare needs require modified behavior guidance approaches, customized to individual needs. Under such circumstances, an amalgamation of a multi-sensory approach and the creative use of other senses could help control their anxiety in the dental operatory. Audio-tactile performance technique (ATP), a specially designed multi-sensory health education method, is an effective communication tool to educate visually impaired children.[28,29]

Figure 5. Tell-Play-Do dental prototypes. A) play models of diagnostic instruments; B) play model of visual examination; C) demonstration of visual examination; D) demonstration of tactile

Audio-tactile performance technique' (ATP), a multi-sensory health education method specially designed, is a very effective communication tool for educating children with special healthcare needs (Figure 6).

Figure 6. Dental chair working model for audiovisual sensations. A: demonstration of a working chair model to a blind child; B: working chair model

Multi-sensory approach ,ntegrated into an adapted environment [Sensory Adapted Dental Environment (SADE)]

Visual Sensation

Color psychology refers to various affective, cognitive, and behavioral responses and associations attributed to a specific color. It is interchangeably used with "the psychological impact of color", as suggested by Van Wagner[30]. According to Kopacz et al.[31], the biological repercussions of color responses can be a valuable tool in health management, and this appears to be a relatively typical understanding of the word. Color therapy, or chroma-therapy, according to Logan-Clarke and Appleby[32], can be used prescriptively as a "holistic, non-invasive, and potent therapy." Blue stimulates calmness and serene feelings and is often portrayed as calm, quiet, peaceful, safe, and well-ordered. Blue can evoke thoughts of melancholy or aloofness. It is tranquil, soothing, and healing but less so than indigo. Green is calming, relaxing, upbeat, and healthy. Green is supposed to help heal and relieve stress. It is a color of balance and harmony, so it might help a person relax under pressure. These concepts of color therapy can be utilized in a dental office to make the environment lessanxiety-provoking.[32] In a study done by Shapiro M[12], all direct overhead fluorescent lighting (50 Hz) was removed, including the regular dental overhead lamp and replaced with dimmed reflective fluorescent lighting (30–40,000 Hz) upward. Their results demonstrated an essential potential effect on children's relaxation during dental hygiene care (Figure 7).

Figure 7. Calming lights in the operatory

Auditory Sensation

Music listening has been suggested to impact health via stress-reducing effects beneficially. It is of great interest that in a study by Cermak S et al.[33], the lowest cortisol concentrations were observed in the acoustic control condition (i.e., listening to rippling water) (Figure 8).

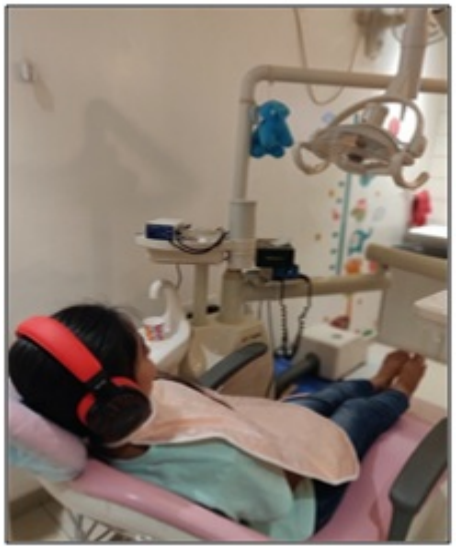

Figure 8. Patient listening to soothing music

Standardized music stimuli can be selected by the researchers or the participants themselves. Music stimulus that had already been evaluated as relaxing can be used as a stimulus with stress-attenuating capacity independent of individual preferences. In a study by Cermak S et al.[33], portable speakers projected rhythmic music. The Music was Dan Gibson's Exploring Nature with Music.[34] They concluded that including auditory sensation in the dental environment created less anxiety & psychological stresses inpatient (Figure 8).

Figure 9. Butterfly wrap as chair insert for tactile stimulation

Tactile Sensory

In a study by Cermak S et al.[33], dental environment was modified using tactile (deep pressure) sensation. The stimulus consisted of a wrap designed to look like a butterfly, adapted from one developed by Shapiro[12], weighted with a regular pediatric dental X-ray vest. The wrap fit over the dental chair should be a washable material and be wiped down after use. The butterfly's wings wrapped around the child from shoulders to ankles and provided deep "hugging" pressure input designed to produce a calming effect.[35,36] These wings were made of soft mesh-like breathable fabric so the child would not feel uncomfortable during the dental cleaning. Colorful felt circles were made and they were detachable from the butterfly "body" allowing for different-sized wings to be used with children. The primary distinction between a butterfly and a traditional papoose board is that the butterfly wrap slips over the dental chair, not requiring the child to be strapped to a board such as that used for the papoose. The effect of tactile stimulation is that it creates a sense of warmth and comfort around children sitting in the dental chair (Figure 9).[36]

Aromatherapy

Lehrner et al.[37]claimed that inhalation aromatherapy could decline anxiety in patients anticipating dental procedures. It is believed that aromatherapy can affect through psychological and physical methods. The odor of aroma makes olfactory nerve cells active, leading to motivation in the limbic system. Depending on the type of aroma, nerve cells release different neurotransmitters. It has long been acknowledged that scents can affect people's emotional state[38.] In a study by Venkatramana M[39], aromatherapy inhalation was proven to be a successful method for lowering patient anxiety before the procedure. The authors assert that it can be used as a creative and practical option based on the results (Figure 10).

Figure 10. Aroma-oil diffuser in clinical area for aromatherapy

CONCLUSIONS

Increment in children's visual, read&/write, auditory, olfactory & kinesthetic tactile abilities can help their readiness for social

communications. Employing this phenomenon in clinical practice can facilitate a distinguished communication medium between the clinician and child. Moreover, a complement of these strategies can be used to make the environment of dental operatory into an enhanced psychological experience for the child during treatment, instilling a positive dental attitude. Thus, communication using a multimodal sensory approach can be essential for behavior modification.

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