

TRABAJO DE FIN DE GRADO

Grado en Odontología

**THE USE OF MULTIMEDIA DEVICES AS
BEHAVIOUR MANAGEMENT TECHNIQUE IN
THE PEDIATRIC DENTISTRY CLINIC**

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ABSTRACT

Introduction: Amongst all dental clinics in the modern day that have access to some form of screen or equivalent multimedia device within the clinic setting. The use of multimedia devices as a real time distraction technique has proven efficacy according to various studies in lowering fear and anxiety in children through the mechanism of distraction.

Objective: the aim of this study was to investigate the use of multimedia devices such as audio, audio-visual, robots and virtual reality aids as behaviour management techniques within the paediatric clinic. The ultimate goal of the use of multimedia devices is being able to achieve greater control, tolerance and post treatment comfort thus ensuring the child doesn't have a negative experience that would lead to later avoidance behaviour which, could manifest into the child not returning to the dental chair in the future.

Material and methods: a search had been conducted within a multitude of electronic databases such as PubMed and Medline. The key elements utilized were: the use of devices to control behaviour of children; iPad for behaviour control in dentistry; virtual reality controlling children's behaviours in dentistry.

Conclusion: The use of multimedia devices has demonstrated efficacy within paediatric patients as a powerful distraction technique that is further augmented with more senses being stimulated; audio was found to be effective and audio-visual even more effective as multi-sensory stimulator thus more distracting to the child.

RESUMEN

Introducción: Entre todas las clínicas dentales actualmente las clínicas dentales pueden tener acceso a algún tipo de pantalla, tablet o dispositivo multimedia. equivalente dentro del entorno de la clínica. El uso de dispositivos multimedia como técnica de distracción en tiempo real ha demostrado su eficacia según diversos estudios para disminuir el miedo y la ansiedad en los niños a través del mecanismo de distracción.

Objetivo: el objetivo de este estudio fue investigar el uso de dispositivos multimedia ya sean de audio solamente, audiovisuales, robots o realidad virtual como ayuda al manejo del comportamiento en la clínica odontopediátrica. El objetivo final del uso es el dispositivo multimedia; es poder lograr un mayor control, tolerancia y comodidad después del tratamiento, lo que garantiza que el niño no tenga una experiencia negativa que conduzca a un comportamiento de evitación posterior que podría manifestarse en que el niño no regrese al sillón dental en el futuro.

Material y métodos: Se realizó una búsqueda bibliográfica en varias bases de datos electrónicas como Pubmed y Medline. Las palabras clave utilizadas fueron; el uso de dispositivos para controlar el comportamiento de los niños; Ipad para el control del comportamiento en odontología; Realidad virtual que controla los comportamientos de los niños en odontología.

Conclusión: El uso de dispositivos multimedia han demostrado ser eficaces como métodos de distracción en la clínica odontopediátrica. Esta eficacia se ve aumentada cuantos mas sentidos se involucran: el método auditivo es efectivo, el audiovisual más y el multisensorial es el que mayor distracción produce.

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1. INTRODUCTION

The behaviour of children during treatment has long stood to be a problem across many professions, not only restricted to dentistry but across all medical fields that encounter paediatric patients. The main difficulty in dentistry which is highlighted upon within several research articles that pain or fear of pain is a primary source of dental anxiety and a major obstacle for seeking dental care (1). This fear far reaches into the fear of needles, to the fear of bodily harm, to a general fear of the unknown (1).

Most children will associate the dentist with removing teeth and various painful treatments (2). Dental anxiety had been studied in the past and been found to occur the moment children enter the dental cabinet where their blood pressure and heart rate begin to increase rapidly which, is their way of demonstrating dental anxiety (2). The noise produced in the dental cabin, the child not having a surrounding they are accustomed to, also potentially the parents having previously had bad experiences, along with a history of painful healthcare interventions all amalgamate together to make the child feel very uneasy and anxious even before they sit in the treatment chair (2).

1.1 THE REASONS THIS AREA IS CONSIDERED PROBLEMATIC AND RESEARCHED UPON

Dental anxiety is a non-specified sentiment of apprehension, worry, uneasiness or dread that the cause of which may be not known and is ranked 5th within the feared circumstances (3) . These deep-seated anxieties and fears, in response to dental work have long seeded roots in primary childhood.

The anxieties within paediatric patients exists in and amongst various countries, across various ethnic groups having incidences of 6-20% (2). As dental anxiety and fear levels spiral out, the patient enters a continuous circle of oral health deterioration due to a build-up of anxiety which leads future aversion behaviour toward dental treatment (2). In the majority of children observed whom presented with dental anxiety, there was a great association with their parents also suffering from dental anxiety which led to them postponing, cancelling or missing their children's appointments due to these anxieties (2).

In 1895 McElroy famously stated that although a dental treatment could be executed perfectly, that the overall treatment would be a failure if the child left the clinic crying following the treatment (3). Over the forgoing history and before the start of digital epoch, the use of pharmacological and more invasive control techniques were heavily employed. As we move forward into new and innovative paediatric dentistry where we find ourselves developing various technological break throughs that steer us more toward non-invasive behaviour control. These non-invasive techniques are being used

as alternatives to the classical methods such as; general anaesthesia, sedation, restraint and hand over mouth. These classical control techniques have never had favour with patients and parents where most parents have always been very apprehensive toward them and prefer the new age non-invasive psychological distraction based control techniques (3). These modern non-pharmacological, psychological based techniques such as tell-show-do, positive reinforcement, non-verbal communication, voice control, memory restructuring, desensitization to dental setting and procedures, enhancing control, communication techniques for parents (and age-appropriate patients), parental presence/absence, sensory adapted dental environments (SADE), animal-assisted therapy (AAT), picture exchange communication system and hypnosis are the current techniques being formulated and developed which are being a lot more accepted and pleasing to parents than the former (4) (5) .

The tell-show-do method is one of the most frequently deployed behaviour management technique. It relies on the principle of learning theory which, states that prior to any treatment being conducted, the child is explained the treatment in advance and demonstrated with the use of dental instruments (which could be toy instruments) as to what will be carried out prior to the treatment being undertaken (6).

Positive reinforcement is another method frequently used in which the child is rewarded for good behaviour after their dental treatment has been completed which is usually by the use of stickers in most dental clinics and not by means of caries-inducing sweets. (7)

Also, non-verbal communication has long been deployed within the paediatric dental clinic which functions as a tool to reinforce, emphasise and complement verbal communication. Within this technique, the dentist must be able to affectively interpret

what the child is attempting to communicate non-verbally as well as verbally during the treatment in order to fully control the behaviour and experience of the child to drive the treatment in a successful non-traumatic direction (8). The parameters which are monitored within this are; the tone of voice, look and psycho-physiological manifestations of fear and/or anxiety which exude from the child or the dentist (8).

In addition, the use of voice control within the paediatric clinic in which the dentist alters the volume of their voice, tone or pace to alter and direct the patient's behaviours, which can be candid or assertive. However if assertive is to be deployed it may be aversive to some parents that are not familiar with the technique (5).

Moreover, Memory restructuring is a technique implemented which attempts to amend previously traumatic memories of a previous dental visit, into good happy upbeat memories that prevent aversive traits e.g. a child's first dental visit was a very bad experience, the memories of this are manipulated into more positive memories using new information following the negative experience in the past event that had occurred using additional information to "clean up" the bad experience. This approach is mainly deployed in patients after they have a negative or difficult dental visit (5).

Furthermore, desensitization to dental settings and procedures which is a technique used by psychologists in clinics that can be applied to alter behaviours of anxious patients. Which is a reduction in the negative feedback to a stimulus through progressive exposure to it for example they may begin with a book or video at home of the procedure and by the time they arrive in the clinic their levels of anxiety toward the same stimulus would have been reduced as they had already been exposed and desensitized to its intensity (5).

Following on to the technique of enhancing control where the patient, particularly an anxious/fearful one gains an active role within the dental treatment. This is used whereby the dentist tells the patient to give a signal whenever they become uncomfortable or require the treatment to be stopped at any point, all of which should be away from the operating field. This technique has been shown to reduce operating pain such as during dental cleanings, restorative procedures and extractions (5).

Subsequently the use of communication techniques for parents (and age appropriate patients) is the approach taken in which the parent's/carers are brought in with an ask-tell-ask, teach back and motivational interviewing techniques are deployed in a bi-directional communication to direct the child's behaviour (5).

The parental presence/absence can be used to enhance paediatric co-operation during treatments. As parents have a maternal/paternal need to want to be with their child during their treatment where they help in examinations, give physical, psychological support and are there watching in real time in their child's dental experiences all in which ultimately leads to a reduction in negative and avoidance based behaviours from the child/parents (5).

Alternatively, Sensory-adapted dental environments (SADE), where the clinic is adapted to the patient e.g. light dimmed, moving projections for example fish or bubbles in the ceiling, music in the backdrop which is soothing, using a wrap/blanket around the child to give a deep pressure input all in which give an overall calming affect (5).

Inversely, Animal-assisted therapy has the main objective in which it uses trained animals within healthcare setting to enhance the interactions/decrease a patient's anxiety, pain or distress. The animal used during the dental treatment can aid in

reducing communication barrier and give the patient the feeling of safety and comfort therefore reducing the treatment related stress (5).

Plus, Picture exchange communication system (PECS) is a technique of communication that was created for people with limited verbal communication skills, where there is an incapability in talking, incomprehensible speech or unprompted or functional speech (especially in patients with Autism Spectrum Disorder). Within PECS, the patient shares a card with a picture, with a recognizable symbol to express a request or thought. PECS has a one-to-one correspondence with objects, people and concepts hence leading to the reduction of ambiguity in communication. E.g. the dentist may have a picture board that describes the treatments, whilst the patient may have a card which has a stop sign to pause the treatment (5) (9).

Finally, hypnosis is also sometimes deployed where a 'hypnotist' pushes the patient to internalise their attention to various scenarios formulated by the hypnotist which are based on the patient's personal experiences and the hypnotists then attempt to alter the patient's perceptions, sentiments, thought and conduct by showing the patient how they may better control the simulated situations (10). The aim of the use of hypnosis within paediatric dentistry is as a distraction technique where, during hypnosis the children can be taught various calming techniques such as relaxation, pleasant imagery and calming self-talk which all can lead to reduced anxiety levels within children during dental procedures (10).

1.2 THE CURRENT STATE OF AFFAIRS AND BACKGROUND

Anxiety had been previously investigated by Rachman (1998) who devised a three pathway theory on the conditioning (direct response), modelling and information (indirect responses) that are the various contributing factors within dental anxiety (3). There are also cognitive contributing factors for increased levels of anxiety observed in children; such as a negative expectation of dental treatment and lack of child-dentist relationship. Conversely existing are non-cognitive factors such as fear of the unknown and learning through vicariousness (3).

Dental anxiety has the highest chance of occurring in paediatric patients. It is defined as a cognitive emotional response to a stimulus or an experience associated with a dental treatment (11).

Dental anxiety is not mono factorial, though it has many factors involved where the main factors involved are; an aversion to the dental office, the indirect learning from role models, various psychodynamic (based on behaviour, feelings and emotions) personality that leads to children's evasive behaviour toward dental treatment (11).

This type of behaviour can not only cause children to avoid going to the dentist all together but also lead to bad behaviour from the child during the visits (11).

The need for distraction techniques were initially unearthed based on the work of McCaul and Mallet (1984) that hypothesised that humans in general have a finite capacity to be attentive. The main fundamental of their theorem was that in order for a person to have a perception of pain they must concentrate on the stimuli thus evoking

it, therefore on the contrary when a person is not concentrating on a painful stimuli their perception of the pain is reduced (12). As a direct consequence of this theorem various studies were conducted with the aim of analysing the process of distraction that needed to grasp onto the child's multiple senses e.g. visual, audio, touch and actively engaging the child's emotions (12).

The use of distraction as a phenomenon is based on the belief that pain perceptions have a large psychological constituent where the quantity of attention that the person is giving to the noxious stimulus governs the level of perceived pain, although the exact mechanism through which they function is not as of now fully understood (12)

The use of distraction as a form of controlling behaviour has prompted numerous studies into the use of multimedia devices such as virtual reality and counter stimulation on dental anxiety and pain perception to local anaesthesia such as the research conducted by Nunna M et al (2019) which widened the scope of the field of distraction and the use of multimedia devices as a vector to deliver the approach (3).

Within this modality the distractor would require an optimal amount of attention involving various modules (such as visual ,auditory and kinaesthetic), in addition the emotional involvement in the distraction that must compete with the stimulus of the noxious stimuli (12).

Distractions function by enchanting the child to a salient attention-occupying visual or auditory activity (e.g. watching TV) that deflect the child from being attentive to sounds, sights and sensations within the dental operatory. However they have not been found to be reliable enough in reducing pain, anxiety or disruptive behaviours (13). One of the

possible reasons for these findings may be due to the distracting stimuli such as television or music may lack sufficient cutting edge to compete for the child's attention i.e. may not be loud enough, close enough or interesting enough to hold the attention of the child to be distractive enough from the dental environment. One way to overcome this is to increase the intensity of the distractive stimuli (13). This theory was developed upon by giving the child a choice of musical soundtracks in order to further distract them, however unsatisfactory results were obtained. This eventually lead to the use of full video eyewear which would have the capabilities to connect to a wide variety of multimedia such as Television, videogames consoles and DVDs that was seen as a combination of video and audio distraction mediums (13) . In addition video eyewear minimally interferes with dental treatment with very little effort from all the dental staff (13)

1.3 THE RELEVANCE FOR THE FUTURE

Dentistry began in its ancestry from a time in which no forms of pain control had been provided to a time when Horace Wells in 1844 was the first to deploy nitrous oxide to anaesthetise a patient during dental extraction, to William T.G. Morton in 1846 who was the first to use ether to anaesthetise patients during dental procedures (14). Times are developing with the use of more and more non-pharmacological methods of controlling and distracting patients.

To aid in the management of children that are anxious, various dental based research has delved into the use of various distraction techniques in an attempt to reduce the innate response of pain that children perceive during various short invasive procedures (1).

The current trend into various behaviour modification and non-pharmacological devices which do not have side effects that have overall better acceptance of the dental treatment by alleviating fear and anxiety are being studied. Previously used non-pharmacological techniques used such as tell show do (TSD), modelling, hypnosis, voice control, biofeedback with guided imagery, audio and audio visual aids and distraction with storytelling that will affect the child on a psychological level (3). The theory by Melzack and Wall (1965) describe the principle of distraction which functions via the stimulation of the larger diameter A and B type nerve fibres in a specific area using appropriate pressure/vibration, decreasing the perception of pain by closing a neural gate to nociceptive signal (3).

The use of virtual reality (VR) distractors with headphones that had been used in various studies that can be seen in figures 1-2. Figure 3 is a visual depiction of the robot used by Yasemine M et al (2016) (15) which is equipped with a tablet computer that is able to run videos, and animations on the front of its stomach. It is also able to show 5 types of facial expressions such as; happy, shy, neutral, surprised and disappointed. Finally Figures 5 and 6 show the design of a simulation for paediatric dentistry in virtual worlds.



Figure 1. VR headpiece with headphones (17)



Figure 2. handheld VR headpiece (16)

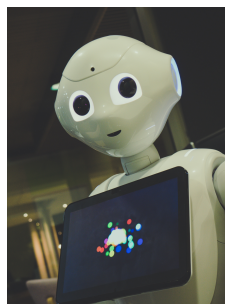


Figure 3. white interactive distraction robot (18)



Figure 5. virtual world simulation of dental clinic (19)



Figure 6. virtual world simulation of dental clinic (19)

1.4 INSTRUMENTS FOR MEASURING ANXIETY AND FEAR

Various methods had been deployed within the quantification of anxiety and fear being experience by the patients within the studies reviewed such as visual analogue scale (VAS), Wong-Baker faces pain rating scale (WBFPS), Venham's clinical anxiety rating scale (VCARS) (3) and Frankl classification method (22).

The visual analogue scale (VAS) was firstly implemented as a tool in measuring psychological states of patients and was further developed to quantify and calculating intensities of pain, where within the field of dentistry it had been implemented on multiple occasions in quantify subjective parameters. This has been a very useful tool within dentistry within the evaluation of anxiety and pain e.g. The patient will have a line, and must indicate where on the line the sensation it:

No pain ————— excruciating pain

(3).

Also Wong-Baker faces pain rating scale (WBFPS) provides us with subjective quantifiable information at the moment of interviewing, where it will provide us with subjective words of the sensations being experienced with faces above each words, with progressive degrees of severity of sensation within the wording and faces which is shown below (20). Figure 1



Figure 1. Wong-Baker faces pain rating scale (20)

The Venham’s clinical anxiety rating scale (VCARS) which is a scale based on six various points based on the co-operation of the child’s behaviour which depicts the various elaborations and gives extra information about paediatric patients non-collaborative behaviour (21) . It is a very precise, non-subjective and ungrudgingly seen behaviour trends of children. It is done by the dentist choosing a score for the patient’s behaviour following dental treatment on a scale of zero to five. An example is shown below in figure 2.

Rating	Definition (behavioral rating scale)
0.	Total cooperation, best possible working conditions, no crying or physical protest
1.	Mild, soft verbal protest or (quite) crying as a signal of discomfort, but does not obstruct progress. Appropriate behavior for procedure
2.	Protest more prominent. Both crying and hand signals. May move head around making it hard to administer treatment. Protest more distracting and troublesome. However, child still complies with request to cooperate
3.	Protest presents real problem to dentist. Complies with demands reluctantly, requiring extra effort by dentist. Body movement
4.	Protest disrupts procedure, requires that all of the dentist attention be directed toward the child behavior. Compliance eventually achieved after considerable effort by dentist, but without much actual physical restraints. More prominent body movement
5.	General protest, no compliance or cooperation. Physical restraint is required

Figure 2. Venham’s clinical anxiety rating scale (VCARS) (21).

Alternatively, another widely regarded and quantifiable scale known as Frankl classification method. It boasts many strengths; such as being very functional as it has been deployed successfully in the past, it is also quantifiable with four categories that can be numerically associated and thirdly it is reliable where data between examiners in concurrent (22).

Categories of Behavior

Rating 1: Definitely negative

Refusal of treatment, crying forcefully, fearfulness, or any other overt evidence of extreme negativism.

Rating 2: Negative

Reluctance to accept treatment, uncooperative behavior, some evidence of a negative attitude but not pronounced (i.e., sullen, withdrawn).

Rating 3: Positive

Acceptance of treatment, at times cautious, willingness to comply with the dentist, at times with reservation but follows the dentist’s directions cooperatively.

Rating 4: Definitely positive

Good rapport with the dentist, interested in the dental procedures, laughing and enjoying the situation.

Figure 3. Frankl's classification method (22)

2. OBJECTIVES

It is well known that children's anxieties can affect the outcomes of all kinds of medical procedures and this holds specific water in treating children within the dental clinic. The success or failure of treating a child will not only affect the child in their current state of oral health. However, there will also be a knock-on effect where the child avoids future treatments that will far extend into their adult lives precipitating into the need for more intensive and more invasive procedures that all stem from childhood traumas.

The primary objective of the investigation was to describe multimedia devices as a behaviour management technique/new technology in the control of behaviour of children.

The secondary objective was to determine if the various multimedia devices were useful in controlling the child's behaviour; to determine their indications; determine their contraindications and the limits of their use in controlling the behaviour of the child.

3. MATERIALS AND METHODS

The search had been conducted via the electronic databases of the UEM library resources (PubMed, Medline, NCBI). The articles chosen for this research were from the year 2010 onward. The keywords used in the search were multimedia; “use of devices to control behaviour of children”; “ipad for behaviour control in dentistry”; “virtual reality controlling children’s behaviours in dentistry”. The inclusion criteria for the articles where only articles within the last 10 years were valid for usage, regardless of language being English or Spanish where the articles had to be relevant to the objective of this investigation. The articles that were older than 10 years, were excluded.

The number of articles initially sought after were 40, however by the end 36 were selected as they were condensed based on the relevance they hold to the subject matter.

4. RESULTS

The table below illustrates; a summary of the articles used, the independent variable studied, sample size and conclusion.

Author	Independent variable	Sample size	Conclusion
Navit S et al (2015)(1)	Audio	150	Reduced levels of anxiety
Ainscough SL et al (2018) (23)	Audio	meta	Music found to be inconclusive in controlling dental anxiety
Gates M et al (2020)(24)	Digital	7820 meta	Lack of evidence to support experimental hypothesis.
IGNA A et al (2018)(25)	Digital	0	General reduction in anxiety and pain
Yasemine M et al (2016)(15)	Robot	33	Reduction in dental anxiety in the robot group
Hoge M et al (2012) (13)	Video eyewear	128	Effective in managing distress, further research required for special needs children.
Mishra R et al (2019) (4)	Audio + audio visual	100	Audio-visual were superior to audio alone in distracting patients.
Naithani M et al 2014 (26)	Audio + audio visual	75	Audio-visual was superior in the management of anxious children to audio alone
Kaur R et al (2018) (27)	Audio and audio-visual	60	Audio-visual distractions was found to be more effective than just audio
Attar RH et al (2015) (28)	Audio-visual	39	Ipad for playing video games was recommended as an active distraction technique.
Bagattoni S et al (2017) (29)	Audio-visual	48	Can be deployed to control distress in special needs paediatric cases without intellectual disability.
Mungara J et al (2018) (30)	Audio-visual modelling	90	Audio-visual modelling lead to significant reduction in fear in addition to specific fear e.g. dentist
Chow CHT et al (2015) (31)	Audio-visual	meta	Found to be useful in lessening paediatric anxiety prior to operations.
Nayana K et al (2019) (32)	Audio-visual	45	Reduction in fear and anxiety during procedures.
Khandelwal D et al (2018) (6)	Audio-visual + tell show do	400	Audio-visual distraction reduced anxiety more than tell-show-do method.
Asvanund Y et al (2015) (33)	Audio-visual	49	Reduced in pain, blood pressure and physical distress.
Zakhary S et al (2020) (34)	Audio-visual	42	Reduced dental anxiety and helped patient enjoy treatment.
Liu Y et al (2018) (11)	Audio-visual	meta	Insufficient evidence in reducing in dental anxiety.
Jimeno F.G et al (2014) (35)	Audio-visual	34	Overall improvement in the traits of the patient.

Bagatoni S et al (2020) (36)	Audio-visual	48	Not found to be useful in Down's syndrome
Zhiang C et al (2018) (2)	Audio-visual	meta	Massive reductions in anxiety in children
López-Valverde N et al (2020) (14)	Virtual reality	meta	Reduces pain and anxiety
Nunna M et al (2019) (3)	Virtual reality vs counter stimulation	70	Virtual reality was found to be more effective in anxiety reduction.
Aminabadi N et al (2012) (12)	Virtual reality distraction	120	Reduce pain and anxiety
Papadupolous L et al (2013) (19)	Virtual world simulation	103	Useful as a teaching tool as an adjunct

Table 1. Condensed results

5. DISCUSSION

After studying all the various articles shown within the previous table, it was found that all the articles studied maybe divided into the following categories; audio, audio-visual, robot and virtual reality.

5.1 THE USE OF AUDIO AIDS SOLELY AS A DISTRACTION TECHNIQUE

The first group investigated were the effectiveness of various audio as distractors for children where we highlight the work of Ainscough SL et al (2018) (23) and Navit S et al (2015) (1).

Following on from the work of Ainscough SL et al (2018) (23) where a systematic review was conducted into the use of music as a distraction tool to reduce dental anxiety within the paediatric clinic lead to inconclusive and data available being of limited quality. However this research was limited in that it focused solely on the effects of music alone, whilst the earlier work of Navit S et al (2015) (1) used various types of audios not merely music as a distractor and were able to extrapolate findings with a higher degree of specificity.

After reviewing the work of Navit S et al (2015) (1) into the use of audio aids (instrumental music, musical nursery rhymes, movie songs and audio stories) in the management of anxious patients. Conclusive evidence was conjured that audio aids generally reduced anxiety in comparison to the control group (no audio distraction) where the most marked reduction in the levels of anxiety were in the group listening to audio stories (1).

5.2 A COMPARISON OF AUDIO AND AUDIO-VISUAL DISTRACTIONS

The second group investigated were the effectiveness of various audio-visual multimedia as distractors for children where we review the works; of Mishra R et al (2019) (4), Attar RH et al (2015) (28), Hoge MA et al (2012) (13) and Filcheck et al (2004).

The work of Navit S et al (2015) (1) was later superseded by the work of Mishra R et al (2019) (4), Naithani M et al (2014) (26) and Kaur R et al (2018) (27) who found conclusive results into the superiority of audio-visual devices over audio only.

Following our review of Mishra R et al (2019) (4) that compared the efficacy of audio with audio-visual distractions within the paediatric clinic. The audio group were subjected to various stimuli with headphones, whilst the audio-visual group were distracted using fixed displays, where the child was able to select the distraction. Results were analysed based on the Venham's anxiety scale where it was found that lower levels of anxiety were reported within the audio-visual distraction group compared to the solely audio, however the difference was not found to be overall statistically significant (4). These results concurred with the findings of Naithani M et al (2014) (26) and Kaur R et al (2018) (27) that also found audio-visual distractions to be superior to simply audio alone, with the latter having the weakest evidence to support their findings amongst the three as a sample of only 60 participants was used whilst Mishra R et al (2019) (4) had the most reliable results as their sample size was the largest at 100 participants. This work by Mishra R et al (2019) (4), Naithani M et al (2014) (26) and Kaur R et al (2018) (27) who found conclusive results into the superiority of audio-visual

devices over audio only has superceded that of Navit S et al (2015) into simply audio (1) and Ainscough SL et al (2018) (23) into the effects of music.

In addition, the research of Attar RH et al (2015) (28) into passive and active distractors by comparing two types of distractors; audio-visual eyewear (the passive distractor) and an active distractor where an Ipad was used where conclusive evidence was found into the use of ipads as an affective device such as that used within the robot by Yasemin M et al (2016) (15) as a means for playing video games. However the work of Yasemin M et al (2016) (15) was restricted by their very small sample of 33 participants which was one of the smallest sample sizes utilized across all the studies studied.

Following on, the investigations of Hoge MA et al (2012) (13) into the efficacy of audio-visual distraction with the use of wrap around video eyewear in the experimental group, whilst the control group used regular sunglasses to manage the distress of children throughout restorative treatments, where it was found that there was significantly less disruptive behaviour in children in the experimental group with the eyewear than those in the control group (13). However, work of Hoge MA et al found that there was insufficient information as to whether or not these findings could be applied to special need children. The work of Bagatoni S et al (2020) (36) into audio-visual distraction effectiveness within Down's syndrome patients was later found to be ineffective across these specific patient sub demographics.

Furthermore, Filcheck et al (2004) found that videotaped material is the best way to change a child's behaviour within the dental clinic setting. Ram et al concluded upon findings that VR eyeglasses were more effective than sedation by nitrous. The use of VR distraction involves various senses e.g. sight, sound and kinesthetics to distract from dental, environmental, social and emotional stresses. Various studies have demonstrated that VR distraction could be better for children with high dental fear and anxiety (3).

5.3 VIRTUAL REALITY

The third group examined the effectiveness of virtual reality as a distraction technique on children, where we reviewed the works of Gates M et al (2020) (24), Asl Aminabadi N et al (12) (2012), Nunna M et al (2019) (3), Papadopoulos L et al (19) (2013) and López-Valverde N et al (2020) (14).

Various treatments have been deployed in attempts to prevent and treat pain and anxiety during dental treatments where one of these being VR simulation which is a 3D world adaptation that use computer aided technologies which immerse the user taking them to an appealing and very interactable surroundings (14). Previous studies into the use of multimedia such as VR, found that VR improved pain control and reduced the perceived duration of the procedure (14). Early research by Ram (2010) et al concluded upon findings that VR eyeglasses were more effective than sedation by nitrous. The use of VR distraction involves various senses e.g. sight, sound and kinesthetics to distract from dental, environmental, social and emotional stresses. Various studies have demonstrated that VR distraction could be better for children with high dental fear and anxiety (3).

Additionally, Asl Aminabadi N et al (2012) studied into the effects of VR distraction on pain and anxiety in patients between the ages of 4-6 years. The participants within the experiemental group were hooked up to a VR device that totally obscured the field of vision of the child with headphones also included, with a cartoon playing the same episode of of "Tom & Jerry" for each participant. Following which participants had their

pain levels measured by the Wong Baker FACES pain rating scale and anxiety was measured by faces model of the Modified Child Dental Anxiety Scale (12), where the results were conclusive with a high P scores of <0.001 on both anxiety and pain perception where pain perception was found to decrease within the experimental group. These findings concur with a meta-analysis conducted by López-Valverde N et al (2020) (14) that also found that virtual reality within paediatric dentistry resulted in a reduction of pain and anxiety.

Alternatively the research of Nunna M et al (2019) (3) on pain and anxiety of patients during local anaesthesia into the effectiveness of virtual reality over counter stimulation. The virtual reality group had a fully immersive headset with a one hundred degree viewing field for the child with three dimensional effects that allowed the child to be fully incorporated within this digital world, then using a smartphone with cartoons on the screen inserted into the device as a passive distractor. The results of which were conclusive where virtual reality was found to be a greater anxiety reducer than counter stimulation where these results concurred with those obtained from the work of Asl Aminabadi N (2012) for the efficacy of virtual reality distractors.

The ground-breaking research of Papadopoulos L et al (2013)(19) which was a very innovative intake where the patient would observe a real time digital simulation within a virtual world. The simulated dentist would conduct a tell-show-do roleplay method to the simulated child. The virtual patient tool was found to be a positive learning tool with the majority of participants (69%) giving the tool a positive feedback experience (19).

5.4 THE USE OF MULTIFUNCTIONAL DIGITAL ROBOT DISTRACTORS

The fourth and final group examined was a remarkable study into the use of robots as digital distractors by Yasemin M et al (2016) (15).

The innovative investigation of Yasemin M et al (2016) (15) into the reduction of dental anxiety and pain using robots using various advanced robots which had an “iPad like” display on their stomachs that were able to show videos and animations, the robot also had lights on its face, with the ability for various facial expressions such as : timid, dissatisfied, impartial, joyful and even shocked and additionally had the ability to react to human touch due to five various sensors. Within this study an overall reduction of anxiety was found through the variation in pulse rates of the children which was observed where an overall drop in pre, during and post pulse rates in the robot group were found to occur in comparison to the control group which were not exposed to the robot (15).

It was discovered that a variation of Children’s behaviour towards dental treatment using Frankl’s behaviour rating scale that allowed a comparison of the Children’s willingness and attitude. The robot group completed the treatment with 93.75% greater positive attitude than prior to the beginning of the treatment compared to the control group that only had a score of 50% (15).

It was furthermore discovered an increase in positive affect (i.e. less dental fear and anxiety) in the robot group and less amount of negative affect also in the robot group

which signifies less dental fear and anxiety (15). This all indicates more positive experiences and less negative feedback within the robot group compared to the control group.

5.5 VARIOUS META-ANALYSIS

In addition, Gates M et al (2020) (24) conducted a meta-analysis into digital technology as a distraction tool such as virtual reality and video games which found that following their review of 106 studies that include 7820 participants in total, digital distraction gave modest pain and distress reductions for children taking on painful treatments (24).

These findings concurred with those by IGNA A et al (2018) (25) into the use of digital technology in dentistry and orthodontics, where it was found that monitors or audio-visual glasses can be seen as very useful aids in the relationship with the child and creating an environment that is relaxed in the dental chair with the main drawback being that the child was not as attentive to the directions of the paediatric dentist, hither to this the VR eyeglasses cover the eyes of the child therefore preventing the dentist's abilities to read the child's body language for any unfavourable effects (25).

6. CONCLUSIONS

- The use of multimedia devices have been demonstrated to be efficacious within the treatment of paediatric patients as a powerful distraction technique.
- The use of audio, audio-visual and virtual reality distraction techniques have been found to effective distraction techniques within the treatments of paediatric patients. With multiple research supporting the comparative efficacy of audio-visual over simply audio.
- The use of active distractors was found to be more efficacious such as an iPad than passive distractors such as audio-visual eyewear, however on the whole audio-visual eyewear has been proven as being a powerful and versatile distraction tool.
- There is still further work to be conducted into the effectiveness of multimedia devices within the treatment of special patient groups such as Down's syndrome as the distractors were not found to be as affective within these groups.
- There is clear evidence to support of further work into the use of virtual reality as a distraction and learning tool within the dental clinic.

7. RESPONSIBILITY

It is the ultimate responsibility of the dentist to ensure that dental treatments are conducted in the least stressful manner possible for our patients. This is especially important when treating children, since bad dental experiences in childhood can lead to manifestations in adulthood. These traumas later manifest to aversive behaviour traits and a reduced quality of life for the patients in later life. These technologies are constantly innovating within the current digital age where many parents already implement these devices into controlling the behaviour of their children at home. The further advances in digital technology are enabling us through distractive mechanisms to improve the paediatric patient care during invasive dental procedures with a positive non-traumatic experience for the child which leads to a fearless future treatment.

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9. ANNEXES

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ORIGINAL SCIENTIFIC ARTICLE



A review of the effect of music on dental anxiety in children

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Abstract

Aim To review the current literature on the effectiveness of using music as an intervention to reduce dental anxiety in children.

Methods At the University of Leeds, the School of Music and the School of Dentistry collaborated to conduct an online search strategy. The Cochrane Library and Medline databases were used to find the current available evidence.

Results Systematic reviews and clinical trial studies as well as cohort studies containing pertinent information on the effect of music on anxiety in the clinical setting were reviewed. The literature showed that music can have a biological and psychological impact on emotion and consequently has been used effectively as an aid to moderate anxiety in the clinical setting. With regard to paediatric dentistry, majority of studies were found to support the use of music in reducing dental anxiety in children, however several additional studies showed that music did not significantly reduce the children's dental anxiety. The studies employed a number of methods to measure dental anxiety including the Venham's Picture Test, the Venham's clinical anxiety rating scale and pulse oximetry. They also used a range of music types; some studies allowed for patient self-selection of music whereas others dictated the music the children listened to.

Conclusions There is an increasing body of evidence to support the use of music to moderate anxiety within the clinical setting in both medicine and dentistry. However, the current evidence for the effectiveness of using music to reduce dental anxiety in children is inconclusive and of limited quality.

keywords Music · Children · Anxiety

Introduction

Music's potential within healthcare settings and its broader application as a health and wellbeing intervention in the community has received much attention from researchers and practitioners in recent years. Although this is partly due to an increasing recognition that the creation, consumption and clinical application of the arts can bring considerable benefit (AHRC 2018), music has received special attention in this respect. Although music has not always been perceived to be beneficial to health (Kennaway 2012) there is a growing evidence- and practice-base that argues the case for a broad range of clinical and community applications

for music in addition to the specificity of music therapy as a clinical practice (Bunt 2014).

Music is seen to have health and/or wellbeing benefits across a spectrum of practices from community choir participation to its use in waiting rooms and surgical settings as background music, both to directly influence mood and arousal levels and to distract from unpleasant thoughts and feelings. Engagement or even just exposure to music can improve mood, offset or mask pain and anxiety, play a role in enhancing cardiovascular fitness, and lead to greater social integration. The evidence-base for such applications varies in quality and generalisability, but has employed measures as diverse as diaries, interviews and questionnaires, adjective scales and standard instruments of psychological state, physiological measures of autonomic state and even the production of hormones such as acetylcholine and cortisol and brain imaging studies (MacDonald et al. 2012).

Dental anxiety currently has a high prevalence in children. The Children's Dental Health Survey in 2013 found that 21% of 5-year-olds and 17% of 8-year-olds were

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Systematic Reviews and Meta-analysis

Appropriateness of various behavior rating scales used in pediatric dentistry: A Review

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ABSTRACT

A youngster's response to dental treatment may greatly facilitate or hinder the course and quality of treatment provided. Numerous children tend to experience various clinical levels of anxiety and some will go on to develop as an anxiety disorder. Estimates suggest that approximately 10–25% of the population may experience an anxiety disorder at some time. Without adequate tools to measure the levels of anxiety in children, it is not possible to isolate the problem and give them the early attention they need. Problems which have arisen in using rating scales typically involve difficulties related to reliability, validity, and measurement level. The major drawbacks of the rating system lie in possible undetected bias and misrepresentation of data. The scorer weighs the evidence on which the rating is based on a complex manner which is not easily specified, standardized, or objectified. The present review was carried out to understand the clinical significance of various behavior rating scales practiced over the years in pediatric practice.

Keywords: Anxiety, Behaviour scales, Children, Rating scales, Management

INTRODUCTION

One of the cornerstones in practicing pediatric dentistry is the ability to guide children positively throughout their dental experience and encourage a positive dental attitude to improve their oral health.^[1] Assessment and management of children based on their behavior are the most important skills for a pediatric dentist. Behavior rating scales are a common component of many multisource, multimethod frameworks for socioemotional and behavior assessment of children. It is important for pediatric dentists to assess and evaluate psychological, personal traits, and behavioral responses of the child,^[2] as they play a major role in the management of dental anxiety and fear. Evaluation of the child's behavior serves as an aid in directing individualized behavior guidance approach that facilitates dental treatment and provides a means for systematically recording behaviors for future appointments.^[1,3]

Many behavioral rating scales for evaluating child's behavior on each dental visit have been reported in literature. The aim of this review article is to analyze different evaluation scales that are used to assess the behavior in children.

CHRONOLOGICAL DEVELOPMENT OF BEHAVIOR RATING SCALE

Frankl's behavior rating scale (FBRS) (1962)

FBRS, developed in 1962, is one of the most widely used behavior evaluation scales in pediatric dental research and in daily clinical practice. It classifies child behavior into four groups

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Clinical Study

A Comparison of Two Pain Scales in the Assessment of Dental Pain in East Delhi Children

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Pain is the most common symptom of oral diseases. Pain perception in children is highly variable and unreliable due to poor communication. Therefore we designed a study to compare pain measurement techniques, that is, visual analogue scale (VAS) and Wong-Baker faces pain rating scale (WBFPS) among Delhi children aged 3 to 14 years undergoing dental extraction. *Method.* A cross-sectional study was conducted on 180 patients aged 3 to 14 years who had undergone dental extraction. Children were assessed for their pain sensitivity using visual analogue scale (VAS) and Wong-Baker faces pain rating scale (WBFPS). *Result and Conclusion.* Pain threshold tends to decline, and the self-management of pain becomes more effective with increasing age. Genderwise result shows that communication ability of boys and girls is similar in all age groups.

1. Introduction

Pain is referred to as the fifth vital sign and is an important reason for which patients seek health care [1]. Scales to assess pain in children have been extensively studied [2]. But there are few pediatric studies to establish the validity of these tools in nonwestern cultures. Pain can be measured by self-report, biological markers, and behaviour because pain is subjective; self-report is the best if available [3]. Even though there are recommended guidelines for assessment of pain in children [4, 5], in India there is still limited data, on use of pain scale in children. It will be useful to know which pain assessment scale is more appropriate in Indian children. At the same time, there is need to evaluate how the health care professionals perceive the pain in children undergoing dental extraction. We have undertaken this study to compare the effectiveness of two pain scales in a dental setup both age-wise as well as gender-wise.

2. Aims and Objectives

The aim of this study is to assess pain in 3–14-year-old children in a dental setup and also to compare pain

measurement techniques, that is, visual analogue scale (VAS) and Wong-Baker faces pain rating scale (WBFPS).

3. Materials and Method

3.1. Study Population. This was a cross-sectional study on 180 paediatric dental patients. The study was conducted in Department of Paedodontics and Preventive Dentistry, University College of Medical sciences & GTB Hospital (University of Delhi).

Inclusion Criteria: Children aged 3 to 14 years of east Delhi were included in the study for perception of pain after obtaining informed consent from parents.

Exclusion Criteria: Nonresidents of Delhi, physically disabled children, medically compromised children, and children who had no previous bad experience in dental clinics were excluded. Patients were divided into three groups on the basis of age:

Group I—3 to 6 years,

Group II—7 to 9 years,

Group III—10 to 14 years.

And each group is further divided on the basis of gender.

Hypnosis for children undergoing dental treatment (Protocol)

Al-Harasi S, Ashley PF, Moles DR, Parekh S, Walters V



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Hypnosis for children undergoing dental treatment (Protocol)
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Behavior Guidance for the Pediatric Dental Patient

Latest Revision

2020

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Purpose

The American Academy of Pediatric Dentistry (AAPD) recognizes that dental care is medically necessary for the purpose of preventing and eliminating orofacial disease, infection, and pain, restoring the form and function of the dentition, and correcting facial disfigurement or dysfunction.¹ Behavior guidance techniques, both nonpharmacological and pharmacological, are used to alleviate anxiety, nurture a positive dental attitude, and perform quality oral health care safely and efficiently for infants, children, adolescents, and persons with special health care needs (SHCN). Selection of techniques must be tailored to the needs of the individual patient and the skills of the practitioner. The AAPD offers these recommendations to inform health care providers, parents, and other interested parties about influences on the behavior of pediatric dental patients and the many behavior guidance techniques used in contemporary pediatric dentistry. Information regarding pain management, protective stabilization, and pharmacological behavior management for pediatric dental patients is provided in greater detail in additional AAPD best practices documents.²⁻⁶

Methods

Recommendations on behavior guidance were developed by the Clinical Affairs Committee, Behavior Management Subcommittee and adopted in 1990.⁷ This document by the Council of Clinical Affairs is a revision of the previous version, last revised in 2015.⁸ The original guidance was developed subsequent to the AAPD's 1988 conference on behavior management and modified following the AAPD's symposia on behavior guidance in 2003¹⁰ and 2013.¹¹ This update reflects a review of the most recent proceedings, other dental and medical literature related to behavior guidance of the pediatric patient, and sources of recognized professional expertise and stature including both the academic and practicing pediatric dental communities and the standards of the American Dental Association Commission on Dental Accreditation.¹² In addition, a search of the PubMed®/MEDLINE electronic database was performed, (see Appendix 1 after References). Articles were screened by viewing titles and abstracts. Data was abstracted and used to summarize research on behavior guidance for infants and children through adolescents, including those with special healthcare needs. When data did not appear sufficient or were inconclusive, recommendations were based upon expert and/or consensus opinion by experienced researchers and clinicians.

Background

Dental practitioners are expected to recognize and effectively treat childhood dental diseases that are within the knowledge and skills acquired during their professional education. Safe and effective treatment of these diseases requires an understanding of and, at times, modifying the child's and family's response to care. Behavior guidance a continuum of interaction involving the dentist and dental team, the patient, and parent directed toward communication and education, while also ensuring the safety of both oral health professionals and the child, during the delivery of medically necessary care. Goals of behavior guidance are to: 1) establish communication, 2) alleviate the child's dental fear and anxiety, 3) promote patient's and parents' awareness of the need for good oral health and the process by which it is achieved, 4) promote the child's positive attitude toward oral health care, 5) build a trusting relationship between dentist/staff and child/parent, and 6) provide quality oral health care in a comfortable, minimally-restrictive, safe, and effective manner. Behavior guidance techniques range from establishing or maintaining communication to stopping unwanted or unsafe behaviors.¹³ Knowledge of the scientific basis of behavior guidance and skills in communication, empathy, tolerance, cultural sensitivity, and flexibility are requisite to proper implementation. Behavior guidance should never be punishment for misbehavior, power assertion, or use of any strategy that hurts, shames, or belittles a patient.

Predictors of child behaviors

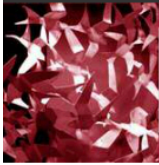
Patient attributes

A dentist who treats children should be able to accurately assess the child's developmental level, dental attitudes, and temperament to anticipate the child's reaction to care. The response to the demands of oral health care is complex and determined by many factors.

Factors that may contribute to noncompliance during the dental appointment include fears, general or situational anxiety, a previous unpleasant and/or painful dental/medical

ABBREVIATIONS

AAPD: American Academy of Pediatric Dentistry. **AAT:** Animal-assisted therapy. **ITR:** Interim therapeutic restoration. **PECS:** Picture exchange communication system. **SADE:** Sensory-adapted dental environment. **SDF:** Silver diamine fluoride. **SHCN:** Special health-care needs.



FAMILIA Y EDUCACIÓN: ASPECTOS POSITIVOS

**COMUNICAÇÃO NÃO-VERBAL NO SETTING DA CONSULTA EM ODONTOPEDIATRIA
NON-VERBAL COMMUNICATION IN THE PEDIATRIC DENTISTRY APPOINTMENT SETTING**

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ABSTRACT

The outcome of any treatment performed in a dental medicine appointment setting is invariably contingent on the quality of the relationship established by the relational pair dentist – patient. In pediatric dentistry, it is nowadays well-known that some disruptive behavior expressed by children during appointments result from dentists' ill-suited communication acts. The current study draws on strategies inherent to non-verbal communication and accesses how non-verbal signs, sent by both, dentists and patients, during pediatric dentistry appointments, are perceived. The methodological procedure consisted in the application of two original questionnaires per group/sample: 208 children aged 6-10 years (G1); 221 dental care practitioners (G2) - dentists and dental medicine students undergoing clinical internship. Those questionnaires provide an instrument for analyzing non-verbal, subliminal signs, sent by children and doctors, allowing thus for an eventual adjustment of pediatric dentistry intervention strategies used in the context of dentist - child relationship.

Keywords: Pediatric Dentistry; Nonverbal Communication; Health education

RESUMO

O desfecho de qualquer tratamento realizado no setting da consulta de medicina dentária é variavelmente contingente à qualidade da relação estabelecida pelo par relacional médico dentista - paciente. Em odontopediatria, sabe-se que alguns comportamentos disruptivos expressados pelas crianças durante as consultas resultam de actos de comunicação não ajustados por parte dos médicos dentistas. Nesse enquadramento, e suportado na comunicação não-verbal, o presente estudo avalia de que forma os sinais não-verbais emitidos durante a consulta em odontopediatria, quer

ARTICLE OPEN

What reward does a child prefer for behaving well at the dentist?

James Coxon¹, Marie Therese Hosey² and Jonathon Timothy Newton³

BACKGROUND: Paediatric dentists often report using positive reinforcement to encourage their young patients to show co-operative behaviour. For effective reinforcement to take place the reward should be salient to the individual. To date, there is little research into what reward a young patient will choose when attending the dentist.

AIM: To identify what reward children between the age of 4–8 years will choose when attending the dentist, and to determine the extent of agreement between children and caregivers in reward choice.

METHOD: Observational study. Fifty-two children from different age groups (4–5 years, 6–7 years and 8 years) attending a primary-care dental clinic were asked to choose between a range of different rewards. The caregiver attending with them was also asked to anticipate the child's preferred choice.

RESULTS: There was no clear favourite reward for children from both genders and different age group. However, no child chose the 'sticker' reward that is traditionally given out at the dentist. Overall carers agreed with the child's choice of toy on 18 occasions (34.6%), but there were significant differences across the age groups with carers of older children showing less agreement

CONCLUSION: To ensure that rewards are salient, children should be given a choice of rewards when attending the dental clinic. Parents ability to predict their child's preferred rewards decreases as the child ages.

CLINICAL RELEVANCE: A child's motivation to co-operate during dental treatment can be increased by offering a range of rewards. Asking children to choose their reward from a limited range will increase the saliency of the reward for the child.

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INTRODUCTION

Paediatric patients frequently show undesirable behaviour that impacts on the ability of the dentist to treat them effectively,¹ and dentists working with children are often required to instigate interventions to decrease the likelihood of these behaviours occurring, using the basic principles of behavioural psychology. These non-pharmacological techniques are widely supported throughout the international paediatric dental field.^{2,3} Positive reinforcement is one of the main behavioural modification methods in current use today.⁴

To allow positive reinforcement to be delivered effectively, the reward should be salient to the individual.⁵ However, there has been little formal research reporting what reward a child would prefer when attending the dentist. Experience suggests that most dental clinics in primary care use stickers as a reward. However, previous research has suggested that dentists' knowledge of the principles underlying behavioural techniques including the use of reinforcement is moderate, at best,^{4,6} Humza Bin Saeed *et al.* 2012 and so it is possible that the use of stickers as a rewards may not be an optimal strategy.

This study sought to research what reward children between the age of 4–8 years would choose as a reward for successful completion of treatment when attending the dentist, and to determine the extent of agreement between children and caregivers in reward choice.

METHOD

Ethical approval was granted by the NRES Committee London—City Road & Hampstead (14/LO/0377). As the burden of participation was small, potential participants were informed of the study and asked to consent on the day of their attendance at the clinic, rather than before appointment. A patient information leaflet for both the child and the adult was given and written assent/consent taken.

A consecutive series of 52 children attending the Chief Investigator's dental surgery were shown 10 different small 'rewards' comprising toys and stickers (each costing less than £2.50 per unit, average cost per unit £1.53, 2016 prices). The rewards shown were different for each age group (4–5 years, 6–7 years and 8 years). The child was asked to indicate which of the 10 objects they would most like to be given after their dental visit. The child's response was then recorded and the child was given the object of their choice after the dental visit, regardless of their behaviour. Independently the child's parent or caregiver was asked to indicate which of the items they believe the child would choose (without knowing which the child chose).

For each adult-child pair the following demographic data were collected:

- Gender of child.
- Age of child.
- Gender of caregiver.
- Relationship of caregiver to child.

The analysis of the data comprised:

1. A frequency count of token choice by child and by caregiver.
2. Calculation of the degree of agreement in object selection by parent and child.

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Control of Anxiety in Pediatric Patients using “Tell Show Do” Method and Audiovisual Distraction

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ABSTRACT

Introduction: Visiting a dentist can easily evoke strong fear reactions and acute anxiety in children. It is one of the most basic reasons for avoidance and neglect of dental care. It may obstruct delivery of dental care, as the child may be unwilling to accept the treatment being provided by the dentist.

Aim: To evaluate and compare reduction in anxiety level in patients undergoing dental treatment at first dental visit.

Technique: The study was conducted on 400 patients coming to the Department of Pedodontics and Preventive Dentistry, Guru Teg Bahadur Hospital, University College of Medical Sciences, New Delhi, for their first dental visit. Anxiety was recorded using facial image scale (FIS), Venham's picture test (VPT), blood pressure, pulse rate (PR), and oxygen saturation (SpO₂) at different stages of the visit. Patients coming for the first dental visit were subjected to restorative treatment under Tell show do (TSD) method and audiovisual distraction (AVD). The data collected were tabulated and subjected to statistical analysis.

Conclusion: The AVD was found to be more capable in reducing anxiety than TSD. Combination of TSD and AVD had an additive effect in reduction of anxiety level and it proved to be more beneficiary.

Clinical significance: If a child's behavior in the dental office cannot be managed, then it is difficult to hold out any dental treatment that is needed. Bringing positivity in the child's behavior would not only increase efficiency of work but would also make the experience for child undergoing treatment more pleasant.

Keywords: Anxiety, Audiovisual distraction, First dental visit.

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INTRODUCTION

Anxiety or fear of unknown during dental treatment has been a concern for the dentist for a long time.¹ Approximately 6 to 15% of the population suffers from high dental fear and anxiety worldwide.² It has been reported as one of the most basic reasons for avoidance and neglect of dental care.³

Dental anxiety is defined as “distressed expectation of a visit to a dentist to the extent where a child might avoid treatment.”⁴ The pediatric patient with his/her first visit to dentist is mostly found anxious and apprehensive because of the dental equipment and the new experience.⁵ The first dental experience is important in molding child's attitude toward dentistry and dental outcome.⁶ It is essential to identify anxious children at the earliest age possible in order to institute a precocious behavioral treatment.

Anxiety can be measured using anxiety scales and physiological measures. Anxiety scales are valid and reliable for assessing children's response to dental stress.⁵ Measurement of autonomic nervous activity is quite useful in assessing the internal stress of children. Two most commonly measured reactions include blood pressure and heart rate.⁷

Dental treatment for children requires use of behavior management techniques for management of anxious children. It is important to communicate with the child patient briefly at the beginning of a dental appointment to establish rapport and trust. When nonpharmacological behavior management technique fails to provide an

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Effectiveness of behavioral modification techniques with visual distraction using intrasulcular local anesthesia in hearing disabled children during pulp therapy

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ABSTRACT

Objective: Assessing the effectiveness of behavioral modification techniques in combination with visual distraction with/without video eyewear using computerized delivery system-intrasulcular (CDS-IS) during the application of local anesthetic in hearing-impaired pediatric patients undergoing pulp therapy of primary molars. **Materials and Methods:** This randomized, crossover clinical study includes 15 children (7 boys and 8 girls), mean age was 6.1 years. Children were randomly distributed into two groups (Group A, $n = 7$; Group B, $n = 8$). The study involved three sessions, 1-week apart. During Session I, employing Tell-Show-Do technique, prophylactic dental cleaning was done while participants were watching a movie with sign-language interpretation with/without visual eyewear. At the end of Session I, score on Smiley Faces Program was used for anxiety assessment. During Session II and III, respectively, both groups underwent pulp treatment of equivalent teeth in the opposite sides of the mouth with/without video eyewear vice versa. After the procedure, children were instructed to rate their pain during treatment on the Wong-Bakers' (WBs') Faces Pain Scale. Changes in pulse oximeter and heart rate were recorded every 5 min. Paired sample *t*-test and independent sample *t*-test were used to assess the significance of changes during each visit. **Results:** There was a significant ($P > 0.04$) change in the heart rate observed for Group A underwent pulp treatment while watching video using video eyewear. Self-reported mean pain score also increases during treatment sessions' with video eyewear, for both groups. **Conclusion:** Routine psychological (Tell-Show-Do) intervention along with visual distraction with full visibility of the surrounding and use of CDS-IS system for anesthetic delivery is recommended as an effective behavior management technique for children with hearing impairment undergoing invasive dental treatment.

Key words: Computerized delivery system-intrasulcular, hearing disability, pulp therapy, visual distraction eyewear

INTRODUCTION

Hearing disability is a condition in which individual is either profoundly hearing impaired, or some have a less severe disability to detect audible frequencies. During dental treatment, they often


faced communication difficulties which are a barrier to get needed care.^[1,2] In addition, several research studies support the proposition that pain or fear

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Scientific Article

RANDOMIZED CONTROLLED TRIAL

Use of Video Eyewear to Manage Distress in Children During Restorative Dental Treatment

Mikala A. Hoge, DDS¹ • Monica R. Howard, MA² • Dustin P. Wallace, PhD³ • Keith D. Allen, PhD⁴

Abstract: *Purpose:* The purpose of this study was to evaluate the effectiveness of video eyewear in reducing disruptive behavior in a typical pediatric dental population during restorative treatment appointments. *Methods:* One hundred twenty-eight 4- to 16-year-olds were recruited from a continuous sample of patients seen in an urban dental clinic. Direct observations of distress, self-reported measures of pain, and patient satisfaction were obtained in a randomized clinical trial comparing 2 different types of glasses: (1) wraparound video eyewear; and (2) sunglasses (typical treatment in this dental clinic). *Results:* Analyses of covariance, using treatment condition (control vs experimental) as the primary independent variable and controlling for the effects of age, found that children wearing video eyewear glasses demonstrated significantly less disruptive behavior than those in the control group and that they liked their eyewear significantly better than those wearing the regular sunglasses. *Conclusions:* Wraparound video eyewear can be an effective approach to managing distress in children undergoing restorative dental treatment. (*Pediatr Dent* 2012;34:378-82) Received February 11, 2011 | Last Revision November 10, 2011 | Accepted November 10, 2011

KEYWORDS: CHILD, ADOLESCENT, DENTAL CARE, PAIN, BEHAVIOR, RANDOMIZED CONTROLLED TRIAL

Reviews of dental literature consistently show that children who present with dental anxiety or dental behavior management problems are a relatively common occurrence in dentistry.^{1,2} Further, the prevalence of dental anxiety and behavior management challenges is often reported to be higher in younger children.^{3,4} The presence of disruptive behavior, whether the result of anxiety, temperament, or simple noncompliance, is of particular concern, given that it can limit children's access to quality oral health care⁵⁻⁷ as well as increase risk of injury, increase the number of staff required to complete procedures, and affect other patients' experiences. Therefore, managing a child's distress during a dental appointment may increase access to care and also contribute to successful treatment for both the child and the pediatric dentist.

Much of the distress exhibited by children during dental treatment is created by the unusual and sometimes unpleasant sights, sounds, and sensations of the dental operator.⁸ Distress is an expected reaction for young children (2-5 years old), for whom the fear of strangers, strange situations, separation from caregivers, noises, masks, and novel stimuli are developmentally appropriate reactions.⁹ Older children, however, may also experience anxiety about a potentially unpleasant situation, particularly in light of children's tendency to overpredict the discomfort they may experience during treatment.¹⁰

Distraction has been examined in a variety of medical and dental settings as a relatively easy, inexpensive, and simple approach to reducing distress and disruptive behavior in children.¹¹

Distraction works by engaging the child in salient attention-occupying visual or auditory activities (eg, watching TV), which then limit the child's attention to sights, sounds, and sensation in the dental operator.¹² Investigations of visual and auditory distraction in the dental clinic, however, have not reliably found reductions in pain, anxiety, or disruptive behavior.¹³⁻¹⁵

One possible explanation for these differing results is that many of the most common distracting stimuli (eg, TV, music) may lack adequate salience to compete for attention. In other words, common distracters may not be loud enough, close enough, or interesting enough to hold a child's attention and distract him or her from the dental environment. Thus, one way to improve the effectiveness of distraction may be to increase the salience of the distractors.

To enhance the salience of an auditory distractor in the dental clinic, one group of investigators added a choice component.¹⁶ Children were provided a variety of music, soundtracks, or audio stories to listen to and could change selections during dental appointments. Even when enhanced with a choice component, however, auditory distraction by itself did not significantly reduce overall distress. Thus, choice alone did not sufficiently enhance the salience of distraction.

One approach that may enhance the salience of distraction is through the use of video eyewear—which refers to a lightweight, goggle-like, portable set of glasses that connects to a variety of media (eg, TV, videogame consoles, and DVD players) and provides private media viewing. Clinically, the use of video eyewear provides a method of distraction that combines visual and auditory distraction, eliminates visual interference, and reduces auditory interference, all in close proximity. Thus, video eyewear has the potential to reduce attention to external disturbances by providing highly salient access to a familiar leisurely activity. In addition, video eyewear appears to offer minimal interference with dental treatment and negligible effort for the dentist or staff.

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Reduction of Dental Anxiety and Pain in Children using Robots

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Abstract—In this study, we aim to use humanoid robots to implement a techno-psychological distraction technique for children between 4-10 years of age in order to reduce their anxiety and stress-related pain during their dental treatment. A multi-modal system supporting audio-based dialogues, videos, gestures and expressions based on face, head, arm, body movements have been developed for a robot. We have employed the Wizard-of-Oz technique, a popular approach in human robot interaction research. The effectiveness of the system is shown by carrying out experiments on two groups of children; one group whose treatment is conducted by the dentist's own skills alone, the other whose treatment is conducted by a dentist with the assistance of the robot. In order to evaluate the robot's effect on the anxiety and fear of children during these experiments, procedures with no anesthesia (not requiring the use of needles) have been carried out. The system has been evaluated subjectively by applying a variety of questionnaires to patients, and dentists as well as objectively by measuring patient's heart rates.

Keywords—Robotics, dental treatment, WoZ experimentation, human robot interaction, multi-modal interaction, healthcare robotics.

I. INTRODUCTION

Dental treatment-related anxiety is a common case in dentistry, especially affecting children and causing problems during their dental treatment. It is common that some children having oral/dental pathology do not comply to have a treatment. Some general methods preferred by healthcare workers are wearing colored and patterned clothes, and using clown doctors to encourage children, to distract their mind and to make medical procedures more fun [1]. Listening to music or watching cartoons are common procedures to relieve the pain and anxiety in children [2]. The goal of all these approach is to reduce unpleasant perceptions, to avoid negative behaviors and escaping from the treatment. In this way, completion of treatment without the need of such advanced medical techniques like sedation and general anesthesia is targeted. These systems may not always be effective enough to distract a child's attention away from pain. According to these analyses, there is obviously a need of a more comprehensive system to enable a child to engage more deeply during medical procedures. Nowadays, combining visual, auditory and tactile stimuli by making use of multi-sensory strategies is believed to provide a greater impact on pain than using a single stimulus. In this study, we aim to direct a child's attention from a painful stimulus to a more entertaining and amusing direction during their dental treatment using a humanoid robot and by making

the therapy session less problematic and more comfortable in order to provide much cozier treatment environment to the dentist.

Moreover, instead of the pediatric dentists communicating with their patients by asking standard questions before treatment, the computer technologies (animation or robot), can take over these repetitive tasks. As a result, the dentist's chair time and energy loss can be minimized. It is targeted to develop positive behavior and increase treatment success.

For the past several years, robotics has been applied in the field of healthcare in various ways. Social and medical robots in this domain aim to motivate and encourage humans to keep up with the medical routine and to provide psychological therapies. The aim of this study is to provide an entertaining, and relaxing environment to the children patients with the help of robots in order to develop positive behaviors in children resulting to an increase in the success of dental treatment and to the circumvention of the high cost and risk of complications such as sedation and general anesthesia. Therefore, to the knowledge of the authors, our work is the first study in our country and in the world, which investigates the effect of child-robot interaction in reducing pain and stress during dental treatment.

II. LITERATURE REVIEW

Dental fear is an emotional reaction against the frightening stimulus during dental treatment. *Dental anxiety* is defined as unease about the fearful events that occur during dental treatment and as a feeling of loss of control accordingly. Negative expectations due to earlier experiences, negative behavior within the family, a feeling of anxiety about the pain, failed and painful experiences that occurred in earlier treatments were reported as the most important factors in feeling fear [3]. Factors associated with dental fear include age, the attitude of parents towards dental treatment, the bad experiences transmitted by those close to the child, concern about sensation of pain and past experiences of the child [3], [4], [5]. In various research works carried out on the human test subjects, the incidence of dental fear, anxiety and behavior management problems in children have been reported to range between 20-74% in several countries (74% in Brazil [6], 30.6% in Singapore [7], 27.02% in Croatia [8], 25.6% in Turkey [9], 23.1% in Sweden [10], 22.2% in Finland [11], 20.6% in Taiwan [12]).

Original Article

Comparative evaluation of the effectiveness of audio and audiovisual distraction aids in the management of anxious pediatric dental patients

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ABSTRACT

Objective: The aim of this study was to evaluate and compare audio and audiovisual distraction aids in management of anxious pediatric dental patients of different age groups and to study children's response to sequential dental visits with the use of distraction aids. **Study Design:** This study was conducted on two age groups, that is, 4-6 years and 6-8 years with 30 patients in each age group on their first dental visit. The children of both the age groups were divided into 3 subgroups, the control group, audio distraction group, audiovisual distraction group with 10 patients in each subgroup. Each child in all the subgroups had gone through three dental visits. Child anxiety level at each visit was assessed by using a combination of anxiety measuring parameters. The data collected was tabulated and subjected to statistical analysis. **Results:** Tukey honest significant difference *post-hoc* test at 0.05% level of significance revealed audiovisual group showed statistically highly significant difference from audio and control group, whereas audio group showed the statistically significant difference from the control group. **Conclusion:** Audiovisual distraction was found to be a more effective mode of distraction in the management of anxious children in both the age groups when compared to audio distraction. In both the age groups, a significant effect of the visit type was also observed.

KEYWORDS: Anxiety, audio and audiovisual distraction, behavior, pediatric dental patients

Introduction

As McElory (1895) wrote "Although operative dentistry may be perfect, the appointment is a failure if a child departs in tears." This was the first mention

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in literature where behavior management of child was given utmost importance than technical excellence. Dental treatment is openly viewed as an unpleasant experience in our society. Fear and anxiety associated with dental treatment are well recognized factors and have a negative impact on patient's willingness to get dental treatment.^[1] The pediatric patient with his/her first visit to dentist are mostly found anxious and apprehensive because of dental equipments and the newness of the experience.^[2]

1. The role of a dentist in managing a child firstly, to control and treat the problem with which the child report with anxiety, so as to make the child a co-operative patient is 3-fold.
2. Secondly, to teach the child appropriate ways of managing the anxiety.
3. Thirdly, to modify and shape the behavior of a child towards a positive dental response.

It is essential to identify anxious children at the earliest age possible in order to institute a precocious behavioral treatment. For this purpose, four kinds of anxiety measuring parameters have been used to assess dental fear and anxiety like physiological means (e.g., pulse rate, basal skin response), psychological/psychometric



Yuwadee
Asvanund

Effect of audiovisual eyeglasses during local anesthesia injections in 5- to 8-year-old children

Yuwadee Asvanund, DDS¹/Kemthong Mitrakul, DDS, DScD¹/Ratana-on Juhong, DDS²/
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Objective: To evaluate the effectiveness of audiovisual (AV) eyeglasses on pain reduction during local anesthetic injection in children who are 5 to 8 years old. **Method and Materials:** Forty-nine healthy, cooperative children with bilateral carious molars requiring treatment under local anesthesia were recruited in this crossover study. Treatments were done in two visits, 1 to 4 weeks apart. Subjects were randomly divided into two groups according to the sequence of AV eyeglasses used. Group I received the injection without wearing AV eyeglasses in the first visit and then wearing AV eyeglasses in a second visit. Group II was vice versa. Self-reporting pain using the Faces Pain Scale-Revised (FPS-R), face, legs, activity, crying, and consolability scale (FLACC), and heart rate (HR), were measured to assess the injection pain. **Results:** No significant differences in sex ($P = .132$) and treatment arch ($P = .779$) were observed

between the two groups using a chi-square test at $P < .05$. There were no significant differences in age ($P = .341$, t test at $P \leq .05$) and previous dental experience ($P = .19$, Fisher's exact test at $P \leq .05$) between the two groups. Pain scores were lower when the patients had their injection while wearing AV eyeglasses in both groups. No subject reported a maximum score on the pain rating scale when wearing AV eyeglasses, while 14% of the subjects reported so when not wearing the eyeglasses. AV eyeglasses significantly reduced FLACC scores ($P = .03$) and HR ($P = .005$) when compared with not wearing the eyeglasses (Mann-Whitney U test at $P \leq .05$). **Conclusion:** AV eyeglasses successfully reduced pain, physical distress, and HR during local anesthesia injection. (*Quintessence Int* 2015;46:513–521; doi: 10.3290/j.qi.a33932)

Key words: audiovisual eyeglasses, dental treatment in children, distraction technique, local anesthesia injection

Pain control is essential in treating child patients. Unfortunately, an intraoral local anesthesia injection during dental treatment is associated with some level of pain. Painless injections and relevant behavior management techniques are needed for creating a positive dental experience when treating child patients.

Research has shown that approximately 14% of 4- to 11-year-old children are anxious when attending a dental clinic, and their strongest fears are associated with injections.¹ Inadequate pain control could lead to a negative dental experience which might develop into dental fear and anxiety and eventually avoidance of dental treatment in the future.^{1,2}

There are many techniques used to lower the pain from local anesthesia injections. Physiologic stimuli such as an application of a topical anesthetic gel or patch prior to the injection, vibration or cooling stimuli, using a warm local anesthetic solution, and a computerized device called a Ward injection system that pre-

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REVIEW

Effect of audiovisual distraction on the management of dental anxiety in children: A systematic review

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Summary

Background: Audiovisual distraction, a non-pharmacological intervention, has been used to manage dental anxiety in prior clinical trials.

Aim: Synthesize the available evidences to evaluate the efficacy of audiovisual distraction techniques on the management of dental anxiety in children.

Design: Electronic databases (PubMed, Cochrane Central Register of Controlled Trials, and Embase) were searched. We included randomized controlled trials (RCTs), and methodological quality of included trials was assessed using the Cochrane Collaboration's criteria. Information on reported anxiety, pain, behaviors, vital signs (including blood pressure, oxygen saturation, and pulse rate), and children satisfaction was analyzed.

Results: Nine studies were included for a systematic review, and none of them had low risk of bias. Significant differences in anxiety were found. According to the study, a majority of results indicated a significant difference in pain and behavior between the audiovisual and control group. Three studies reported children in the audiovisual group preferred usage of an audiovisual device for future dental visits. No significant differences could be found regarding blood pressure.

Conclusions: There is some low-quality evidence suggesting that the usage of audiovisual distraction during dental treatment may relieve children's dental anxiety.

1 | INTRODUCTION

Dental anxiety occurs most commonly in children. It is defined as a cognitive emotional response to a stimulus or an experience associated with a dental treatment.¹ In New Delhi, the prevalence of dental anxiety ranges between 7.4% and 22.6% for children between ages 3 and 14 years,² the consequence the same to a review that prevalence of dental anxiety in youth samples ranges from approximately

5% to 20%.³ Dental anxiety is a multifactorial phenomenon, caused by three main factors: aversive in the dental office, vicarious learning through role models, and psychodynamic and personality,⁴⁻⁶ which can cause children to avoid dental visits and negatively influence the behavior during the course of dental visit, thereby resulting in more teeth decay and gingivitis in future, and this can potentially exacerbate the child's level of dental anxiety.^{3,7-10} So the dentist plays an important role in decreasing or eliminating dental anxiety in the patient and promoting good general oral hygiene habits.¹¹

Yunkun Liu and Zhiyu Gu are equally contributed to this work.

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Effect of audiovisual distraction on children's behaviour, anxiety and pain in the dental setting

ABSTRACT

Aim To evaluate whether the parental perception of the patient's anxiety, children's anxiety, pain, behaviour and heart rate of paediatric patients improves when an audiovisual technique is used as a distraction method during dental treatment.

Materials and methods This non-randomised crossover trial was performed with 34 patients aged 6–8 years, who required a minimum of two treatment visits for restorative therapy. During the last visit, the patient was shown a cartoon film.

Results There was a significant improvement in the global behaviour when children were shown a cartoon film ($P < 0.001$). A significant increase in heart rate was recorded in both visits ($P = 0.0001$) when the anaesthetic was injected. A 97% of the sample would like to continue seeing their chosen film during subsequent visits. No statistically significant differences were found ($P > 0.05$) between the visits in terms of parental perception of the patient's anxiety, or the patient's self-reported anxiety, pain and heart rate.

Conclusions The use of the audiovisual material used as a method of distraction produces a global improvement in patient behaviour, but not in parental perception of the patient's anxiety, self-reported anxiety, pain or heart rate according to the measurement scales used. This material is also highly accepted by paediatric patients.

Keywords Anxiety; Audiovisual distraction; Behaviour; Child management; Pain.

Introduction

Dentistry exposes patients to an environment and particular experiences that trigger a natural response of fear in many people. This might lead to difficulties in persuading patients to accept certain types of treatment [Barber, 1982].

Managing the behaviour of paediatric patients requires continuous interaction with the patient and their parents for the purpose of communication. A key aim of any dentist when managing patient behaviour is to reduce fear and anxiety, while promoting good dental health and strategies to achieve this [Li and Lopez, 2005]. According to Wright et al. [1983], all dental health teams should have 2 main objectives: to carry out dental treatment effectively and efficiently; and to encourage a positive attitude in children. However, these objectives conflict with the anxiety that many children experience when confronted with certain aspects of dentistry. It is important that dentists are able to evaluate anxiety in their patients, in order to identify children who require special care with regard to fear [Buchanan and Niven, 2002]. Many professionals consider that children who show uncooperative behaviour are one of the greatest problems in their practice [Ingersoll et al., 1984a].

Given the need to reduce anxiety in these children, many techniques have been developed with this consideration in mind. Among the most common concerns in relation to behaviour management techniques, are parental acceptance, legal and ethical aspects, feasibility, and access when carrying out some of these techniques. These concerns have led to the modification of techniques to address behaviour management over recent years [Corah et al., 1979; Ingersoll et al., 1984a; Ingersoll et al., 1984b; McTigue, 1984; Davila and Menendez, 1986; Sullivan et al., 2000; Aitken et al., 2002; Luis de Leon et al., 2010]. For example, paediatric dentists have had to limit the use of certain techniques that are efficient but are not considered to be acceptable by parents (e.g., passive restraint and hand-over-mouth techniques) [Murphy et al., 1984; Lawrence et al., 1991; Luis de Leon et al., 2010]. Other techniques which are considered more acceptable have had to be promoted [Corah et al., 1979; Murphy et al., 1984; Davila and Menendez, 1986; Lawrence et al., 1991; Gatchel, 1992; Luis de Leon et al., 2010].

Techniques or methods that enable the drug-free management of children's behaviour include distraction using audiovisual equipment, music, hypnosis, and the help of child psychologists [Parkin, 1981; Venham et al., 1981; Ingersoll et al., 1984a; Ingersoll et al., 1984b; Stark et al., 1989; Baghdadi, 2000; Sullivan et al., 2000; Frere et

Original Article

Child's dental fear: Cause related factors and the influence of audiovisual modeling

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ABSTRACT

Background: Delivery of effective dental treatment to a child patient requires thorough knowledge to recognize dental fear and its management by the application of behavioral management techniques. Children's Fear Survey Schedule – Dental Subscale (CFSS-DS) helps in identification of specific stimuli which provoke fear in children with regard to dental situation. Audiovisual modeling can be successfully used in pediatric dental practice. **Aim:** To assess the degree of fear provoked by various stimuli in the dental office and to evaluate the effect of audiovisual modeling on dental fear of children using CFSS-DS. **Materials and Methods:** Ninety children were divided equally into experimental (group I) and control (group II) groups and were assessed in two visits for their degree of fear and the effect of audiovisual modeling, with the help of CFSS-DS. **Results:** The most fear-provoking stimulus for children was injection and the least was to open the mouth and having somebody look at them. There was no statistically significant difference in the overall mean CFSS-DS scores between the two groups during the initial session ($P > 0.05$). However, in the final session, a statistically significant difference was observed in the overall mean fear scores between the groups ($P < 0.01$). Significant improvement was seen in group I, while no significant change was noted in case of group II. **Conclusion:** Audiovisual modeling resulted in a significant reduction of overall fear as well as specific fear in relation to most of the items. A significant reduction of fear toward dentists, doctors in general, injections, being looked at, the sight, sounds, and act of the dentist drilling, and having the nurse clean their teeth was observed.

KEYWORDS: Audiovisual modeling, Children's Fear Survey Schedule – Dental Subscale, dental fear

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Introduction

Dental fear among children is an issue of great concern to both dentists and their patients' parents. The etiology of a child's dental anxiety can be multifactorial. Various causes have been proposed which include direct or indirect influences of the past experiences of the child and his/her family members and peers.^[1,2]

A child's behavior pattern in any situation is governed by his/her inherited physical and mental endowment and, as he develops, by the conditioning he receives through contact with the environment. The former, except within certain narrow limits, cannot be altered. The latter can be controlled and developed, so the child will grow to have a well-adjusted personality suited to the situation.^[3] Children have relatively limited communication skills and are less able to express their fears and anxieties. Children's inability to cope with threatening dental stimuli often manifests as behavior management problems. Early recognition and management of this dental fear is the key to delivering effective dental treatment to the child patient.

The behavioral sciences have become an increasingly important component of dental education and

The Impact of Virtual Reality Distraction on Pain and Anxiety during Dental Treatment in 4-6 Year-Old Children: a Randomized Controlled Clinical Trial

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Abstract

Background and aims. Dental practitioners have numerous methods to control anxiety and pain in children, and distracting the child appears to be the most common technique used for behavior management during dental procedures. The aim of the present study was to evaluate the influence of using virtual reality eyeglasses on severity of pain and anxiety during dental procedures in pediatric patients.

Materials and methods. This study included 120 healthy children aged 4-6 years. Children with no previous anxiety disorder were randomly divided into two groups, each consisting of 60 children. The study consisted of 3 consecutive treatment sessions. During the first visit fluoride therapy was carried out in both groups. In the next sessions, the groups received restorative treatment with and without virtual reality eyeglasses in a randomized single-blind-controlled crossover fashion. Then at the end of each session the subjects' pain severity was assessed using Wong Baker FACES Pain Rating Scale and state anxiety was measured by Faces version of the Modified Child Dental Anxiety Scale [MCDAS (f)].

Results. There was a significant decrease in pain perception ($P < 0.001$) and state anxiety scores ($P < 0.001$) with the use of virtual reality eyeglasses during dental treatment.

Conclusion. Results of this study showed that virtual reality eyeglasses can successfully decrease pain perception and state anxiety during dental treatment. Trial registration number: 201103126036N1.

Key words: Anxiety, dental treatment, distraction, pain, virtual reality.

Introduction

Pain and anxiety are unpleasant feelings and emotional experiences, which are associated with

real or possible traumas to tissues.¹ Management strategies have been proposed to reduce distress during dental treatment in children and are mainly di-

A Comparison of Audio and Audio-Visual Distraction Techniques in Managing Dental Anxiety in Pediatric Patients: A Clinical Study

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ABSTRACT

Background: Pain and fear of pain makes dental treatment very difficult for clinician as well as patients. Minimizing fear and anxiety can help to treat patients more comfortably. Various techniques like audio distraction, audio visual distraction are used to minimize anxiety.

Aim: To compare audio and audio-visual distraction techniques in managing dental anxiety.

Methods: 100 children visiting the Department of Dentistry, UPUMS, Saifai for routine dental care were examined. The selected 100 children were randomly allocated to 2 groups. Group 1: audio distraction and Group 2: audiovisual group.

Results: Venham's anxiety scale was found to be lower in audiovisual distraction group, although the difference was not found to be statistically significant during all the visits. Relatively less increase in pulp rate was also observed in audio visual distraction group in current study.

Conclusion: Audiovisual distraction technique can be

preferred over audio distraction in paediatric patients.

Keywords: Audio Distraction, Audio Visual Distraction, Anxiety.


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INTRODUCTION

Pain is not the sole reason for fear of dentistry. Anxiety or the fear of unknown during dental treatment is a major concern for dentists for a long time. Dental pain and anxiety are unpleasant feelings and emotional experiences, which are associated with real or possible trauma to tissues.¹ A wide variety of technique is available for management of pain and anxiety however because of changing attitude of parents and society; non-aversive techniques like distraction are becoming more popular.²

Various techniques used are talk-show-do, positive reinforcement, nonverbal communication, voice control, and distraction.³⁻⁵ Distraction is a common technique in the dental practice which diverts the child's attention from what may be perceived as an unpleasant procedure, shifting their focus to engrossing and fascinating distractors.⁶

Distraction can be both audio distraction as well as visual distraction. However the combination of audio and visual i.e. audiovisual technique is even more effective. AD is a simple and low-cost technique that does not interfere with the dental treatment. This technique partially occludes the environment, while allowing child-clinician communication. So in present study we aimed to study a comparison of audio and audio-visual distraction techniques in managing dental anxiety.

AIM

To compare audio and audio-visual distraction techniques in managing dental anxiety

OBJECTIVES

1. To evaluate the effect of audio-visual distraction technique using chair mounted monitor on dental anxiety and pain in children.
2. To evaluate the effect of audio distraction technique on dental anxiety and pain in children.
3. To compare the effect of audio and audio-visual on dental anxiety and pain in children.

MATERIALS AND METHODS

This randomized controlled crossover clinical study was carried out in the Department of Dentistry, UPUMS, Saifai. Ethical committee approval was obtained from the Institutional Ethics Committee. A written informed consent was obtained from the parents of the selected children. The children visiting the Department of Dentistry for routine dental care were screened and 100 children with following inclusion Criteria were included for the present study.

ORIGINAL ARTICLE

Child's Dental Anxiety: Management by Audio and Audio-visual Distraction Technique - A Comparative Study

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ABSTRACT

Introduction: The child's emotional and behavioral response to dental treatment is a matter of serious concern to the pediatric dentist. Children usually respond to dental visits with some fear and anxiety. Therefore, the main aim of the present study was to evaluate and compare two distraction techniques, namely audio distraction and audio-visual distraction in the management of anxious pediatric patients along with an additional parent's perspective on the same subject. **Material and Methods:** The study comprised of 75 children aged between 4-8 years divided into 3 groups of 25 each. The children were then subjected to 4 visits and at the end of each visit the anxiety levels were assessed using a combination of Venham Picture Test (VPT), Venham Rating of Clinical Anxiety (VRCA), Child Fear Survey Schedule (CFSS), Pulse Rate and Oxygen Saturation. **Results:** The results of our present study showed that Venham's Picture Test (VPT) was significant when compared with Venham Rating of Clinical Anxiety (VRCA), Child Fear Survey Schedule (CFSS), Pulse Rate and Oxygen Saturation during all the visits with the significant value ranging from 0.00001 to 0.0311 in both inter and intra group comparison. **Conclusion:** It was concluded that audio-visual distraction was superior to audio distraction alone; furthermore, parents were seen to gauge their progeny's fear more than the child did.

KEY WORDS: Anxiety, audio distraction, audio-visual distraction, child fear survey schedule-dental subscale, parent

INTRODUCTION

Dental fear and/or anxiety are a constant challenge posed to every pediatric dentist in everyday dental practice. In the Indian population, an estimated 6.3-9.4% of children between the age group of 10-15 years suffered from dental fear.^[1] The child's hesitancy or uncooperative behavior may curb the effective delivery of dental care that may compromise the quality of treatment provided.

A vast array of behavior management techniques are available to the dentist to help tackle the fearful child and help promote a positive dentist-child relationship.^[2] The success of techniques like Tell-Show-Do have been well documented in the past, nevertheless it is not always suitable or adequate for every patient. Papoose board and hand over mouth techniques can also be effective; however the attitude of parents and dental professionals toward these techniques is changing.

Distraction is the technique of diverting the patient's attention from what may be perceived as an unpleasant procedure.^[3] The accomplishment of distraction technique has been affirmed in medical set-ups however insufficient matter is available to gauge the potency of this technique in terms of pediatric population.^[2]

In addition to the Pedodontist, the parent also has an equally important role in making a child's initial dental experience a positive one. Hence, the parents view on their progeny's dental fear and/or anxiety is essential information to be gained.^[4]

Therefore, the objective of this study was to evaluate and compare audio and the audio-visual distraction techniques in the management of anxious pediatric patients; and in addition to assess whether parents are accurate reporters of their child's dental fear.

MATERIALS AND METHODS

The study was conducted in the Department of Pedodontics and Preventive Dentistry, Krishnadevaraya

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Effectiveness and Comparison of Various Audio Distraction Aids in Management of Anxious Dental Paediatric Patients

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ABSTRACT

Background: Dental anxiety is a widespread phenomenon and a concern for paediatric dentistry. The inability of children to deal with threatening dental stimuli often manifests as behaviour management problems.

Nowadays, the use of non-aversive behaviour management techniques is more advocated, which are more acceptable to parents, patients and practitioners. Therefore, this present study was conducted to find out which audio aid was the most effective in the managing anxious children.

Aims and Objectives: The aim of the present study was to compare the efficacy of audio-distraction aids in reducing the anxiety of paediatric patients while undergoing various stressful and invasive dental procedures. The objectives were to ascertain whether audio distraction is an effective means of anxiety management and which type of audio aid is the most effective.

Materials and Methods: A total number of 150 children, aged between 6 to 12 years, randomly selected amongst the patients who came for their first dental check-up, were placed in five

groups of 30 each. These groups were the control group, the instrumental music group, the musical nursery rhymes group, the movie songs group and the audio stories group.

The control group was treated under normal set-up & audio group listened to various audio presentations during treatment. Each child had four visits. In each visit, after the procedures was completed, the anxiety levels of the children were measured by the Venham's Picture Test (VPT), Venham's Clinical Rating Scale (VCRS) and pulse rate measurement with the help of pulse oximeter.

Results: A significant difference was seen between all the groups for the mean pulse rate, with an increase in subsequent visit. However, no significant difference was seen in the VPT & VCRS scores between all the groups. Audio aids in general reduced anxiety in comparison to the control group, and the most significant reduction in anxiety level was observed in the audio stories group.

Conclusion: The conclusion derived from the present study was that audio distraction was effective in reducing anxiety and audio-stories were the most effective.

Keywords: Dental anxiety, Venham's picture test, Venham's clinical rating scale

INTRODUCTION

Despite major advances in dentistry in terms of techniques, technologies and materials, anxiety related to the dental environment and specific procedures is a significant and common problem faced by child patients worldwide and considered as an obstacle in providing quality dental care.

Various aspects and factors are involved in the acquisition and development of dental anxiety in children. It not only concerns fear of pain or of invasive procedures, but also entails separation from the parents, confrontation with unfamiliar people and surroundings and the experience of loss of control [1].

In the Indian population, an estimated 6.3-9.4% of children between the age groups of 10-15 years suffer from dental fear [2]. A vicious cycle has been proposed in relation to dental fear whereby dental fear leads directly to the avoidance of dental visits, resulting in deterioration in oral health, leading to more problem-oriented visiting, which serves to maintain or exacerbate the person's level of dental fear. This avoidance creates feelings of shame, guilt and inferiority, further maintaining this negative spiral by reinforcing one's fear and avoidance behaviour [1].

AAPD has outlined a series of behaviour management techniques to deal with the problem, ranging from voice control, to distraction, to physical restraint. When all else fails, sedation with drugs such as nitrous oxide has been advocated [3]. Behaviour management techniques are meant to reduce the need for excessive and

potentially unsafe use of medications. There is evidence to indicate that an integration of good behavioural techniques leads to better results, lessened drug requirements, greater patient safety and reduced side-effects [4].

The present trend advocates the use of non-aversive behaviour management techniques which may be equally effective and more acceptable to parents, patients and practitioners. In distraction, the patient's attention is diverted from what may be perceived as an unpleasant situation [5]. Audio distraction is a non-aversive distraction technique in which patients listen to music or stories during a stressful procedure. The accomplishment of audio distraction technique has been affirmed in medical setups however scanty literature is available to gauge the potency of this technique in terms of paediatric population [2].

Researchers have identified several mechanisms by which music works to reduce anxiety. The first is the Gate Control Theory of Pain, proposed by Ronald Melzack and Patrick Wall in 1965 [6]. This theory states that pain signals are transmitted from the place of injury, via nerve receptors in the spinal cord, to synapses that receive the pain information in the brain. Music is believed to send enough competing sensory inputs through pathways descending from the brain to cause the brainstem to signal some of the gates shut, thereby reducing the amount of pain that the patient listening to the music perceives [7].

A second mechanism is distraction. Noguchi defines this as "any

Systematic Review: Audiovisual Interventions for Reducing Preoperative Anxiety in Children Undergoing Elective Surgery

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Abstract

Objective To examine the effectiveness of Audiovisual (AV) interventions at reducing preoperative anxiety and its associated outcomes in children undergoing elective surgery. **Methods** A systematic review of randomized controlled trials (RCTs) and nonrandomized studies where the primary outcome was children's preoperative anxiety was conducted. Secondary outcomes included postoperative pain, behavioral changes, recovery, induction compliance, satisfaction, and cost-effectiveness. The risk of bias of each study was assessed. **Results** In all, 18 studies were identified. A meta-analytic approach and narrative synthesis of findings were used to summarize the results of the studies. **Conclusions** This systematic review suggests that AV interventions can be effective in reducing children's preoperative anxiety. Videos, multi-faceted programs, and interactive games appear to be most effective, whereas music therapy and Internet programs are less effective. While AV interventions appear potentially useful, adequately powered RCTs are required to conclusively pinpoint the components and mechanisms of the most effective AV interventions and guide practice.

Key words: anxiety; children; educational interventions; meta-analysis; randomized controlled trial; systematic review.

Introduction

Preoperative Anxiety

Exposure to pediatric surgical procedures is a relatively common and significant stressor for children. It is estimated that up to 5 million children undergo elective surgical procedures in North America every year, and nearly 75% of them experience considerable preoperative anxiety (Perry, Hooper, & Masiongale, 2012). This distress is highest during general anesthetic induction procedures during which anticipatory anxiety is provoked (Davidson & McKenzie, 2011).

Surgery can produce emotional distress and trauma for children and their families if they are psychologically ill-prepared.

Research has shown that there are individual differences in children and their parents in terms of who are likely to respond negatively to surgical procedures. In particular, it has been suggested that, high trait anxiety and low sociability in children and high anxiety in parents are predictive of elevated levels of perioperative anxiety (Fortier, Del Rosario, Martin, & Kain, 2010; Li & Lopez, 2005). In adolescents, baseline



Comparative evaluation of virtual reality distraction and counter-stimulation on dental anxiety and pain perception in children

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Background: This study evaluated the efficacy of virtual reality (VR) distraction and counter-stimulation (CS) on dental anxiety and pain perception to local anesthesia in children.

Methods: A prospective, randomized, single-blinded interventional clinical trial with a parallel design was used. Seventy children 7–11 years old who required local anesthesia (LA) for pulp therapy or tooth extraction were recruited and allocated to two groups with equal distribution based on the intervention. Group CS (n = 35) received CS and Group VR (n = 35) received VR distraction with ANTVR glasses. Anxiety levels (using pulse rate) were evaluated before, during, and after administration of local anesthesia, while pain perception was assessed immediately after the injection. Wong-Baker faces pain-rating scale (WBFPS), visual analog scale (VAS), and Venham's clinical anxiety rating scale (VCARS) were used for pain evaluation. Student's t-test was used to test the mean difference between groups, and repeated measures ANOVA was used to test the mean difference of pulse rates.

Results: Significant differences in mean pulse rates were observed in both groups, while children in the VR group had a higher reduction (P < 0.05), and the mean VCARS scores were significant in the VR group (P < 0.05). Mean WBFPS scores showed less pain perception to LA needle prick in the CS group while the same change was observed in the VR group with VAS scores.

Conclusions: VR distraction is better than CS for reducing anxiety to injection in children undergoing extraction and pulpectomy.

Keywords: Counter-Stimulation; Dental Anxiety; Distraction; Pain Perception; Virtual Reality.



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INTRODUCTION

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described regarding such damage, according to the International Association for the Study of Pain [1]. In

dentistry, untreated carious teeth involving the pulp are the primary cause of pain in adults and children [2]. To alleviate this pain and to successfully perform the treatment, local anesthesia (LA) administration is a widely used method, which also frequently triggers fear and anxiety in patients [3]. Dental fear is a usually unpleasant emotional reaction to specific frightening

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Contingent Escape With or Without Audio Visual Distraction Aids – In Behaviour Management of Children Aged 4-8 Years.

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Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

Background: Dental anxiety in children causes avoidance of treatment and increased stress among caregivers that affects the treatment quality. The aim of this study was to evaluate effectiveness of contingency escape with or without audio visual distraction in management of child patients.

Materials and methods: 45 children in age group 4-8 years with Frankel's behaviour rating scale 2 ; requiring simple dental restorations were included in study. They were randomly divided into 3 groups of 15 each. Group 1- contingency escape with video, Group 2- contingency escape without video and Group 3 -control group. Facial image scale, FLACC (Face, leg, activity, cry, consolability) score, pulse oximeter were used to assess child's behaviour 'before treatment' , 'after implementing behaviour modification technique- during the treatment'

and 'after finishing treatment'. A validated Dentist compliance questionnaire is used to assess ease of handling patient.

Results: Contingency escape with audio visual distraction found to be statistically significant in managing paediatric patients. (P value < 0.05)

Conclusion: Children who used oral health education video during treatment reported less anxiety and more positive response than control groups. Contingent escape with audio visual distraction effectively reduced fear and anxiety in children during dental treatment.

Keywords: Audiovisual distraction, Contingent escape, FLACC scale

Introduction

The primary goal for a dental professional is to treat their patients in an anxiety-free environment along with a high quality dental care. To achieve this, dentists have to

AUDIO-VISUAL DISTRACTION EFFECT ON HEART RATE IN CHILDREN DURING DENTAL TREATMENT, A RANDOMIZED CLINICAL TRIAL

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ABSTRACT

Background: Dental anxiety is one of the causes of avoiding dental visits in children and is associated with physiological body reactions as increased heart rate. Different behavior management techniques have been used to reduce dental anxiety among them are Tell-show-do technique and audiovisual (AV) distraction.

Aim: To determine the effect of audiovisual distraction on heart rate during dental treatment in children.

Subjects and methods: Forty-two patients requiring pulp therapy were randomly allocated to either control group (managed by tell-show-do technique) or test group (managed by audiovisual distraction using virtual reality eyeglasses). Heart rate measures were recorded for all patients before the treatment and every five minutes during the procedure. Results were tabulated and statistically analyzed.

Results: There was a statistically significant difference in heart rate mean values between both study groups. Where AV distraction group showed better results in lowering anxiety.

Conclusions: Audiovisual distraction can be considered an effective method for reducing anxiety during dental treatment and helping the patients enjoy the dental visit.

KEYWORDS: Tell-show-do, behavior management, audiovisual distraction, dental anxiety, heart rate.

INTRODUCTION

Children are victims of fear and anxiety more than adults since children are exposed to more insecurities in their life from movies, cartoons,

school and communication with others. Children are also more difficult to handle within the dental visit because of their inability to express their fear and cope with fearful stimulations such as pain or fearful objects (Vilela & Ogawa, 2019).

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Article

Use of Virtual Reality for the Management of Anxiety and Pain in Dental Treatments: Systematic Review and Meta-Analysis

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Abstract: (1) Background: Dental treatments often cause pain and anxiety in patients. Virtual reality (VR) is a novel procedure that can provide distraction during dental procedures or prepare patients to receive such type of treatments. This meta-analysis is the first to gather evidence on the effectiveness of VR on the reduction of pain (P) and dental anxiety (DA) in patients undergoing dental treatment, regardless of age. (2) Methods: MEDLINE, CENTRAL, PubMed, EMBASE, Wiley Library and Web of Science were searched for scientific articles in November 2019. The keywords used were: “virtual reality”, “distraction systems”, “dental anxiety” and “pain”. Studies where VR was used for children and adults as a measure against anxiety and pain during dental treatments were included. VR was defined as a three-dimensional environment that provides patients with a sense of immersion, transporting them to appealing and interactive settings. Anxiety and pain results were assessed during dental treatments where VR was used and in standard care situations. (3) Results: 32 studies were identified, of which 8 met the inclusion criteria. The effect of VR in children was significant, both for anxiety (standardized mean difference (SMD) = -1.75) and pain (SMD = -1.46). (4) Conclusions: The findings of the meta-analysis show that VR is an effective distraction method to reduce pain and anxiety in patients undergoing a variety of dental treatments; however, further research on VR as a tool to prepare patients for dental treatment is required because of the scarcity of studies in this area.

Keywords: virtual reality; distraction systems; dental anxiety; pain

1. Introduction

Pain suppression during dental interventions has been a major accomplishment for humankind. In 1842, William E. Clarke gave ether to a patient for the removal of a tooth; later, in 1844, a dentist named Horace Wells used nitrous oxide as an anesthetic for dental extractions; and in 1846, another dentist,

Comparative efficacy of active and passive distraction during restorative treatment in children using an iPad versus audiovisual eyeglasses: a randomised controlled trial

R. H. Attar · Z. D. Baghdadi

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Abstract

Aim This study aimed to compare the effects of two types of distraction techniques: passive, using audiovisual glasses (AV glasses), versus active, using an iPad, as an adjunct to local analgesia during vital pulp therapy in children.

Methods Pain behaviour, and heart rates from an exposure group (treatment with the aid of an iPad) and control group (treatment with the aid of AV glasses) were compared in a randomised, split-mouth design using the Wilcoxon signed rank test (pain and behaviour) and paired *t* test for heart rate scores at *p* 0.05.

Results Children (39) (mean age 6.27 years) received the two treatment sessions. Generally, AV glasses had higher pain and behaviour scores than iPad. Pain results demonstrated marginal significant differences between the two distraction techniques during local analgesia administration (*p* 0.076) and caries removal (*p* 0.071). A significant difference between the two techniques during local analgesia administration only (*p* 0.017), in favour of an iPad. Average heart rates over the treatment intervals were lower among iPad group than those using AV glasses group. Patients preferred an iPad more than AV glasses

(24 versus 15). Treatment sessions were significantly shorter for iPad.

Conclusions Active distraction using an iPad demonstrated better performance than passive distraction using AV glasses.

Keywords Audiovisual distraction · Active distraction · Behaviour management · Passive distraction · Paediatric dentistry

Introduction

Anxiety and pain are common reasons many children give for not visiting a dentist. A previous painful or traumatic experience with a dental professional and/or negative beliefs and perceptions of dental settings may give rise to anxiety associated with dental treatment. In children, maternal (or parental) anxiety and their beliefs and attitudes regarding dentistry affect child's behaviour at dental appointments and treatments (Nakai et al. 2000; Pinkham 2000; Bankole et al. 2002). Performing some procedures without local analgesia (LA) or less than adequate anaesthesia are reasons for patients feeling pain during dental treatment that in turn affects their behaviour in future appointments which is not uncommon in child dental care (Koch and Poulsen 2009). Severe pain may be experienced when a vital dental pulp is involved in treatment (Koch and Poulsen 2009). While injectable LA is considered to be a cornerstone in controlling pain during dental procedures, the injection itself can be painful and needles are considered the most fearful and anxiety-provoking tool in dentistry (van Wijk and Hoogstraten 2009; Hembrecht et al. 2013; El-Sharkawi et al. 2012). Treatment duration, which is related to complexity of dental treatment, has been found

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Article type : Review Article

Does audiovisual distraction reduce dental anxiety in children under local anesthesia? A systematic review and meta-analysis

Running title: Dental anxiety in children

Keywords: Dental anxiety, Audiovisual distraction, Local anesthesia, Children

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Effectiveness of audio visual distraction using virtual reality eyeglasses versus tablet device in child behavioral management during inferior alveolar nerve block

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ABSTRACT

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Aim: The aim of this study was to evaluate the effectiveness of two different audiovisual distraction techniques, e.g. audio-visual (AV) eyeglasses – virtual reality box (VR Box) or a Tablet) in the management of anxious pediatric patients during inferior alveolar nerve block (IAN) block.

Study design: A randomized clinical trial carried out on 102 children (60 boys and 42 girls) aged between 6 and 10 years (mean age of 7.4 years) to investigate the effect of using VR eyeglasses 'VR Box' and tablet device with wireless headphone in reducing the dental anxiety of children during IAN administration.

Methodology: 102 children were randomly divided into three groups; Group A (Control group): IAN administrated with basic behavior guidance techniques and without using any type of distraction aids. Group B: IAN administrated with using AV eyeglasses 'VR Box' and wireless headphone. Group C: IAN administrated with using tablet device and wireless headphones. The participants were selected from children attending the department of the pediatric dentistry at the Faculty of Dentistry, Damascus University, who required local anesthesia (LA) administration in the mandibular arch. All of the children who experienced an IAN block with/without distraction were assessed by using a combination of measures: Wong-Baker FACES (self-report), pulse rate (physiological) and behavior (using FLACC behavior rating scale ('external evaluator').

Results: 101 children completed the study out of 102 children. There was no statistically significant difference in the anxiety of audiovisual groups as reported by the Wong-Baker FACES values ($p = 0.536$) and FLACC scale ($p = 0.454$). However, there was a statistically significant difference in the anxiety and pain level in pulse rate ($p = 0.043$).

Conclusions: Distraction using video shown on tablet device was the best in relieving dental anxiety and pain during IAN block. Although using 'VR Box' had no added advantage in a majority of children, 'VR Box' was more acceptable in older patients (8-10 years) than younger patients and gave the children some exciting experiences which may lead to far better behavior in the next dental visits.

Key words: Distraction; Behavior management; Children's dental anxiety.

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Digital Technology Distraction for Acute Pain in Children: A Meta-analysis

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abstract

CONTEXT: Digital distraction is being integrated into pediatric pain care, but its efficacy is currently unknown.

OBJECTIVE: To determine the effect of digital technology distraction on pain and distress in children experiencing acutely painful conditions or procedures.

DATA SOURCES: Medline, Embase, Cochrane Library, Cumulative Index to Nursing and Allied Health Literature, PsycINFO, Institute of Electrical and Electronics Engineers Xplore, Ei Compendex, Web of Science, and gray literature sources.

STUDY SELECTION: Quantitative studies of digital technology distraction for acutely painful conditions or procedures in children.

DATA EXTRACTION: Performed by 1 reviewer with verification. Outcomes were child pain and distress.

RESULTS: There were 106 studies ($n = 7820$) that reported on digital technology distractors (eg, virtual reality and video games) used during common procedures (eg, venipuncture, dental, and burn treatments). No studies reported on painful conditions. For painful procedures, digital distraction resulted in a modest but clinically important reduction in self-reported pain (standardized mean difference [SMD] -0.48 ; 95% confidence interval [CI] -0.66 to -0.29 ; 46 randomized controlled trials [RCTs]; $n = 3200$), observer-reported pain (SMD -0.68 ; 95% CI -0.91 to -0.45 ; 17 RCTs; $n = 1199$), behavioral pain (SMD -0.57 ; 95% CI -0.94 to -0.19 ; 19 RCTs; $n = 1173$), self-reported distress (SMD -0.49 ; 95% CI -0.70 to -0.27 ; 19 RCTs; $n = 1818$), observer-reported distress (SMD -0.47 ; 95% CI -0.77 to -0.17 ; 10 RCTs; $n = 826$), and behavioral distress (SMD -0.35 ; 95% CI -0.59 to -0.12 ; 17 RCTs; $n = 1264$) compared with usual care.

LIMITATIONS: Few studies directly compared different distractors or provided subgroup data to inform applicability.

CONCLUSIONS: Digital distraction provides modest pain and distress reduction for children undergoing painful procedures; its superiority over nondigital distractors is not established. Context, preferences, and availability should inform the choice of distractor.



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The data pertaining to this research are available from the corresponding author on reasonable request.

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REVIEW ARTICLE

Effects of audiovisual distraction in children with special healthcare needs during dental restorations: a randomized crossover clinical trial

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Background. Audiovisual distraction using video eyeglasses is useful in managing distress and reducing fear and anxiety in healthy children during dental treatments.

Aim. To evaluate the effect of audiovisual distraction on behavior and self-reported pain of children with special healthcare needs (SHCN) without intellectual disability during dental restorations and its influence on the operator stress and the time of the appointment.

Material and methods. This randomized controlled crossover trial comprised 48 children with SHCN requiring at least two dental restorations. One restoration was done wearing the video eyeglasses and one wearing conventional behavior

management techniques. Subjective and objective pain was evaluated using the Faces Pain Scale – Revised (FPS-R) and the revised Face, Leg, Activity, Cry, and Consolability scale (r-FLACC). The operator stress using a VAS, the time of the appointment, and the child satisfaction were recorded.

Results. The use of video eyeglasses significantly reduced the operator stress. The bivariate analysis showed that the mean FPS-R score and the mean r-FLACC score were significantly lower using the video eyeglasses only during the second clinical session.

Conclusion. Audiovisual distraction could be useful in managing distress in SHCN children without intellectual disability but cannot replace the conventional behavior management techniques.

Introduction

In the definition of 'special healthcare needs (SHCN)', the American Academy of Pediatric Dentistry included 'any physical, developmental, mental, sensory, behavioral, cognitive, or emotional impairment or limiting condition that requires medical management, healthcare intervention, and/or use of specialized services or programs¹. Oral health is an important component of the general health. In many cases, oral diseases can compromise the overall well-being of the individual, particularly in children with congenital heart disease in combination with a risk of infective

endocarditis or in children with compromised immunity (e.g., cancer, transplant)². Children with SHCN have an increased risk for caries, periodontal diseases, and malocclusion throughout their lives in comparison with the healthy population³. Oral pathologies can be closely related to the underlying medical disease or caused by a poor oral hygiene, drug assumption (e.g., caries from sweetened syrups), and harmful oral habits (e.g., malocclusions in children with oral breathing). A difficult access to specialized medical facilities represents an additional barrier⁴.

Children with SHCN are exposed to multiple medical experiences, such as injections, hospitalizations, and surgeries. Consequently, their access to dental treatment may be delayed and greater anxiety levels are expected⁵. The previous negative medical experiences, in association with cognitive factors concerning the dental situation (such as a fear to perceive pain), seem to be the most

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Effects of audiovisual distraction in children with Down syndrome during dental restorations: a randomised clinical trial



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Abstract

Aim To evaluate the effect of audiovisual distraction on the dental chairside behaviour of children with Down syndrome (DS) during dental restorations and its influence on the operator stress and the duration of the appointment.

Materials and Methods Study design: This randomised controlled trial included 48 children with DS requiring dental restorations. The study group was treated while wearing video eyeglasses, the control group with conventional behaviour management techniques. The child behaviour was evaluated using the revised Face, Leg, Activity, Cry, Consolability scale (r-FLACC) and the Frankl scale. The operator stress was evaluated using a VAS scale and the duration of the appointment was recorded.

Results In the study group 64% of the children refused to wear the video eyeglasses during the whole duration of the dental treatment, the median r-FLACC score was significantly higher ($p=0.01552$; Mann Whitney U test) and significantly more children showed a negative behaviour (68% vs 30%; $p=0.011$; Chi-square test).

Conclusion Audiovisual distraction using video eyeglasses is not useful in managing the dental chairside behaviour of children with DS.

KEYWORDS Down Syndrome, Distraction, Behaviour.

Introduction

Down syndrome (DS) is the most common chromosomal abnormality and the most common cause of intellectual disability. The incidence ranges from 1 in 650 to 1 in 1,000 live-births [Sherman et al., 2007]. DS is characterised by typical facial features and by a mild-moderate physical and intellectual developmental delay [Weijerman and De Winter, 2010]; congenital heart defects are diagnosed in 50% of individuals [AAP, 2001]. Oral health is an important component of the general health; furthermore, in children with congenital heart disease at risk of infective endocarditis, oral diseases can pose a threat to life [AAPD, 2012; Descamps and Marks, 2015].

The behavioural management of patients with DS can be challenging due to a delay in cognitive development with specific deficits in speech, language production and auditory short-term memory and due to impairments in adaptive behaviour [Will et al., 2018]. Because of a lack of understanding, children with intellectual disability may exhibit resistant behaviours that interfere with the safe delivery of the dental

treatment. When the parent/caregiver's assistance is not feasible or effective, sedation or general anaesthesia is the behavioural management modality of choice [AAPD, 2012]. In the recent years the use of audiovisual distraction has become very popular in paediatric dentistry: many studies demonstrated the efficacy of video eyeglasses in managing distress and reducing dental fear and dental anxiety in children [Asl Aminabadi et al., 2012; El-Sharkawi et al., 2012; Hoge et al., 2012; Al-Namankany et al., 2014; Mitrakul et al., 2015; Nuvvula et al., 2015; Al-Khotani et al., 2016; Alnamankany, 2019]. Based on this scientific background, a previous study was conducted to test the efficacy of this behavioural management technique in children with special healthcare needs during dental treatments [Bagattoni et al., 2018]. The use of video eyeglasses significantly reduced the operator stress, but there was no improvement in children pain-related behaviour, self-reported pain and mean duration of the appointment. To achieve a homogeneous sample, children with intellectual disability were excluded, considering that a factor which might have affected the results.

The aim of this study was to evaluate the effect of audiovisual distraction on dental chairside behaviours in children with intellectual disability affected by Down syndrome and its influence on the operator stress and duration of the appointment.

Materials and methods

Participants

This randomised case-control study was conducted on outpatients attending the Unit of Special Needs Dentistry and Paediatric Dentistry, Department of Biomedical and NeuroMotor Sciences, University of Bologna, Italy, referred from the Paediatric Unit of St. Orsola-Malpighi Polyclinic, Department of Medical and Surgical Sciences, University of Bologna, Italy. A written informed consent for participation and publication was obtained from the parents/legal guardians of each patient in full accordance with the ethical principles of the Helsinki Declaration. The investigators were three dentists trained in special needs dentistry and involved in a previous research protocol to test the applicability of the audiovisual distraction in children with special healthcare needs without intellectual disability [Bagattoni et al., 2018]. The research protocol of this study was part of a project approved by the local Ethics Committee of the Bologna University Hospital Authority St.



Comparative evaluation of virtual reality distraction and counter-stimulation on dental anxiety and pain perception in children

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Background: This study evaluated the efficacy of virtual reality (VR) distraction and counter-stimulation (CS) on dental anxiety and pain perception to local anesthesia in children.

Methods: A prospective, randomized, single-blinded interventional clinical trial with a parallel design was used. Seventy children 7–11 years old who required local anesthesia (LA) for pulp therapy or tooth extraction were recruited and allocated to two groups with equal distribution based on the intervention. Group CS (n = 35) received CS and Group VR (n = 35) received VR distraction with ANTVR glasses. Anxiety levels (using pulse rate) were evaluated before, during, and after administration of local anesthesia, while pain perception was assessed immediately after the injection. Wong-Baker faces pain-rating scale (WBFPS), visual analog scale (VAS), and Venham's clinical anxiety rating scale (VCARS) were used for pain evaluation. Student's t-test was used to test the mean difference between groups, and repeated measures ANOVA was used to test the mean difference of pulse rates.

Results: Significant differences in mean pulse rates were observed in both groups, while children in the VR group had a higher reduction ($P < 0.05$), and the mean VCARS scores were significant in the VR group ($P < 0.05$). Mean WBFPS scores showed less pain perception to LA needle prick in the CS group while the same change was observed in the VR group with VAS scores.

Conclusions: VR distraction is better than CS for reducing anxiety to injection in children undergoing extraction and pulpectomy.

Keywords: Counter-Stimulation; Dental Anxiety; Distraction; Pain Perception; Virtual Reality.



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INTRODUCTION

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described regarding such damage, according to the International Association for the Study of Pain [1]. In

dentistry, untreated carious teeth involving the pulp are the primary cause of pain in adults and children [2]. To alleviate this pain and to successfully perform the treatment, local anesthesia (LA) administration is a widely used method, which also frequently triggers fear and anxiety in patients [3]. Dental fear is a usually unpleasant emotional reaction to specific frightening


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Effect of audiovisual distraction on the management of dental anxiety in children: A systematic review

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Summary

Background: Audiovisual distraction, a non-pharmacological intervention, has been used to manage dental anxiety in prior clinical trials.

Aim: Synthesize the available evidences to evaluate the efficacy of audiovisual distraction techniques on the management of dental anxiety in children.

Design: Electronic databases (PubMed, Cochrane Central Register of Controlled Trials, and Embase) were searched. We included randomized controlled trials (RCTs), and methodological quality of included trials was assessed using the Cochrane Collaboration's criteria. Information on reported anxiety, pain, behaviors, vital signs (including blood pressure, oxygen saturation, and pulse rate), and children satisfaction was analyzed.

Results: Nine studies were included for a systematic review, and none of them had low risk of bias. Significant differences in anxiety were found. According to the study, a majority of results indicated a significant difference in pain and behavior between the audiovisual and control group. Three studies reported children in the audiovisual group preferred usage of an audiovisual device for future dental visits. No significant differences could be found regarding blood pressure.

Conclusions: There is some low-quality evidence suggesting that the usage of audiovisual distraction during dental treatment may relieve children's dental anxiety.

1 | INTRODUCTION

Dental anxiety occurs most commonly in children. It is defined as a cognitive emotional response to a stimulus or an experience associated with a dental treatment.¹ In New Delhi, the prevalence of dental anxiety ranges between 7.4% and 22.6% for children between ages 3 and 14 years,² the consequence the same to a review that prevalence of dental anxiety in youth samples ranges from approximately

5% to 20%.³ Dental anxiety is a multifactorial phenomenon, caused by three main factors: aversive in the dental office, vicarious learning through role models, and psychodynamic and personality,⁴⁻⁶ which can cause children to avoid dental visits and negatively influence the behavior during the course of dental visit, thereby resulting in more teeth decay and gingivitis in future, and this can potentially exacerbate the child's level of dental anxiety.^{3,7-10} So the dentist plays an important role in decreasing or eliminating dental anxiety in the patient and promoting good general oral hygiene habits.¹¹

Yunkun Liu and Zhiyu Gu are equally contributed to this work.

DIGITAL TECHNOLOGY IN PAEDIATRIC DENTISTRY AND ORTHODONTICS

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Abstract

Digital dentistry is a concept getting more and more contour nowadays, due to the latest technological advancements registered in the field. This paper makes a review of the existing digital technologies in dentistry, which have proven their usefulness in Pediatric Dentistry and Orthodontics, as well. Whether they aid diagnosis, or simplify procedures for both pediatric dentist and patient, or create a friendly environment, digital devices contribute significantly to increasing the quality of the therapeutic act.

Keywords: *pediatric dentistry, digitalization, patient-friendly.*

1. INTRODUCTION

Advancements in technology have led medicine to a new era. Digital dentistry is not a concept anymore, but a full hands-on reality today, enabling patients to receive modern solutions to traditional dental problems. Among the digital technologies available for dentistry, there are some which have already proven their usefulness in Pediatric Dentistry, as well. *Digital radiography*, along with a range of modern *non-invasive caries detection tools*, aid the practitioner in diagnosis, while *computer-controlled delivery of local anesthetic or nitrous oxide*, *digital impressions*, *CAD/CAM restorations*, *digitally-based surgical guides* enhance treatment possibilities. *Digital photography* and *virtual reality* are particularly useful in patient management, especially in pediatrics, as growth monitoring and behavioral management are two of the main concerns in Pediatric Dentistry. All above mentioned techniques incorporate the latest technological findings and aid practitioners to provide their

patients a leading-edge dental treatment, with improved efficiency, precision and comfort.

2. DIGITAL RADIOGRAPHY

Early detection and diagnosis of the carious lesion is a primary consideration of the Minimal Intervention Dentistry (MID) concept, being particularly important in pediatric patients, due to the rapid caries progression in primary teeth [1,2]. As the primary enamel is thinner than the permanent enamel, its mineral content is lower, its porosity is higher and caries lesions progress faster than in permanent teeth[3]. It was suggested that radiographic examination should be included as part of the initial patient assessment and also in the process of monitoring lesion behavior over time. Radiographs are the most used detection aids using the bitewing technique. The aim of bitewings is to detect proximal caries lesions that cannot be observed by visual inspection. However, in occlusal surfaces, the contribution of radiographs seems to be minimal[4]. Lately, digital radiography has taken over the conventional radiography techniques. A digital sensor is used instead of the conventional film and the radiographic image is stored in a computer. Two types of digital receptors can be used in image acquisition: charge-coupled device (CCD) or photostimulable phosphor (PSP). Digital radiographs permit the use of computer facilities, such as image enhancement and processing, and even the possibility of sending images to other colleagues

BEHAVIOR MANAGEMENT IN DENTISTRY FOR CHILDREN

SECOND EDITION

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Application of Behavior Management Techniques for Paediatric Dental Patients by Tanzanian Dental Practitioners

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Abstract: *Background:* Management of children's behavior is an integral component of pediatric dental practice. *Objective:* To investigate the oral health care providers' awareness, use and factors for choice of behavior management techniques when attending paediatric dental patients. *Methods:* A cross-sectional study among dental practitioners in Dar es Salaam, Tanzania. Data collection was done through interview using a structured questionnaire. The recorded information included: awareness and application of behavior management techniques (BMT) when attending a child dental patient, factors influencing choice of a particular technique, socio-demographics, level of professional training, working experience and facility profile. Using SPSS program version 18, frequency distributions and cross tabulations analyses were performed. *Results:* 74 dental practitioners participated in the study, of whom 49 (66.2%) were males and 44 (59.5%) were graduates. Most participants were aware of the behavior management techniques, ranging from 100% for Tell-Show-Do to 86% for distraction. A small proportion (9.5%) reported to have adequate skills, all of them were graduates. The use of universally accepted BMTs was reported by 65% of experienced practitioners, 61% of graduates, 59% of those reporting to have received formal training and all of those reporting to have fair/inadequate skills to apply BMTs ($p=0.01$). *Conclusion:* Most participants were aware of BMTs, although few acknowledged having adequate skills to apply the techniques. They use BMTs during treatment of paediatric dental patients and their choice of the technique is mainly influenced by children's factors.

Keywords: Awareness, behavior management techniques, paediatric, practitioners, professional training, Tanzania.

INTRODUCTION

Management of children's behavior is an integral component of pediatric dental practice [1]. It is as fundamental to the successful treatment of children as are hand piece skills and knowledge of dental materials in dental practice [2] and it is achieved through application of various Behavior Management Techniques (BMTs). BMTs are a set of procedures aimed at enhancing the child's useful coping skills, achieve complete willing and acceptance of dental care, and ultimately reduce the child's perception that the dental situation is overwhelming or dangerous [1]. In other words, the techniques are employed by dental practitioners in attending a child dental patient so as to establish communication, alleviate fear and anxiety, facilitate delivery of quality dental care, build a trusting relationship between dentist, child, and parent, and promote the child's positive attitude towards oral/dental health and oral health care thus cope with and be willing to undertake dental treatment procedures [3-5].

Approaches for behavioural management changed considerably during the second half of the 20th century, with an increasing emphasis on communication and empathic skills [6]. They have been codified into professionally derived

guidelines [7]. To date, a wide variety of behavior management techniques are available to dental practitioners [8, 9], namely; tell-show-do, desensitization, modeling, positive reinforcement, voice control, distraction, parental presence/absence, restrain/protective stabilization, non verbal communication, hand-over-mouth, sedation and general anaesthesia.

Behavior management techniques have been classified as pharmacological as opposed to non pharmacological, communicative (communication and communicative guidance) versus advanced behavior guidance techniques and universally accepted against non-universally accepted ones, as well as informal and common sense techniques *versus* formal relaxation techniques [1, 10]. The classification into universally and non-universally applied techniques was used during analysis and reporting in this article.

Different authors have reported application of BMTs in different countries/societies. In the United States, Carr and Wilson [8] reported that the Southeastern US dentists used less aversive techniques and reported a marked reduction in the use of the hand over mouth exercise. A survey among active members of the American Academy of Pediatric Dentistry residing in the U.S. and Canada showed that only a minority used hand-over-mouth and active immobilization of sedated patients. No significant differences by groups were seen in respect to the use of most basic behavior management techniques. Significant differences by sex and age were seen for the use of non-verbal communication and advanced

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Original Paper

Design and Evaluation of a Simulation for Pediatric Dentistry in Virtual Worlds

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Abstract

Background: Three-dimensional virtual worlds are becoming very popular among educators in the medical field. Virtual clinics and patients are already used for case study and role play in both undergraduate and continuing education levels. Dental education can also take advantage of the virtual world's pedagogical features in order to give students the opportunity to interact with virtual patients (VPs) and practice in treatment planning.

Objective: The objective of this study was to design and evaluate a virtual patient as a supplemental teaching tool for pediatric dentistry.

Methods: A child VP, called Erietta, was created by utilizing the programming and building tools that online virtual worlds offer. The case is about an eight-year old girl visiting the dentist with her mother for the first time. Communication techniques such as Tell-Show-Do and parents' interference management were the basic elements of the educational scenario on which the VP was based. An evaluation of the simulation was made by 103 dental students in their fourth year of study. Two groups were formed: an experimental group which was exposed to the simulation (n=52) and a control group which did not receive the simulation (n=51). At the end, both groups were asked to complete a knowledge questionnaire and the results were compared.

Results: A statistically significant difference between the two groups was found by applying a *t* test for independent samples ($P<.001$), showing a positive learning effect from the VP. The majority of the participants evaluated the aspects of the simulation very positively while 69% (36/52) of the simulation group expressed their preference for using this module as an additional teaching tool.

Conclusions: This study demonstrated that a pediatric dentistry VP built in a virtual world offers significant learning potential when used as a supplement to the traditional teaching techniques.

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