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Research Article

AUDIO SENSORY VIDEO INTERFACE: A NOVEL INNOVATION TO AID INTRAPROCEDURAL COMMUNICATION BETWEEN PAEDIATRIC DENTAL PATIENTS AND PAEDODONTISTS- A RANDOMIZED PILOT TRIAL

Gandhi Henal Alpesh*., Prashanth Sadashiva Murthy and Girish M S

Department of Paedodontics and Preventive Dentistry JSS Dental College and Hospital (constituent college)
JSS Academy of Higher Education and Research Jagadguru Sri Shivarathreeshwara University
JSS Medical Institutions Campus Sri Shivarathreeshwara Nagar
Mysuru-570015 Karnataka, India

A R T I C L E I N F O

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Behaviour management, Dental technology, Distraction, Extraction, Intra-procedural communication.

A B S T R A C T

Aim: The aim of the randomized pilot trial was to evaluate the efficiency of the AuSVIn in par with the conventional hand gesture communication that is usually followed universally during the dental procedures.

Objectives: This study comparatively evaluates the communication efficiency of conventional hand gestures and Audio Sensory Video Interface device during dental procedures and anxiety alleviating potential of Audio Sensory Video Interface device in pediatric patients during dental procedure.

Methods: It's a Parallel split-mouth study with 14 subjects, wherein, every child was compared to himself/herself with two different modes of communication i.e. AuSVIn and hand gesture in separate appointments spaced one week apart. Sequentially Numbered Opaque Sealed Envelopes (SNOSE) were used for allocation and concealment for the selection of the mode of communication to be used in the subjects on the day of the dental procedure. Following the first procedure a washout period of one week was allocated before the cross arch procedure in the second appointment in which the other communication mode was assessed. To record the patient's response objectively, a biometric record of patient's heart rate was done. Each child's Heart rate was monitored during the treatment at different intervals and during intraprocedural response with a pulse oximeter.

Results: Mean heart rate throughout the procedure, heart rate during LA administration and heart rate during intraprocedural responses shows statistically significant difference between the two modes of communication. With the heart rate being consistently lower in when AuSVIn is used as the communication mode.

Conclusion: The study shows that AusVIn has the potential of being not only an effective distracter but also an efficient and effective mode of communication between the child and the Paedodontist.

Clinical significance: Behavior management and effective communication between a dentist and the child are crucial factors required for a successful paedodontic practice. The innovation mentioned in the present study, AuSVIn, is assessed for its efficiency in aiding communication and role in alleviating apprehension through distraction, to claim with scientific evidence, its role as a tool in behavior management.

INTRODUCTION

Great strides have been accomplished recently in providing better medical and dental services for pediatric patients. Parents and caregivers often have concerns about their child's tolerance of dental appointments. Paedodontists should recognize that each child is unique and may need extra care to feel comfortable. Even with extensive technological advancements in the field of dentistry, effective communication between a child and the paedodontist during the dental therapeutic procedure depends largely on the hand gestures of a willing patient. Intra-operatively the ability of a child to verbally communicate is restricted by the use of rubber dam during endodontic therapy, matrices and retainers during restorative procedures or the very presence of the skilful hands of the paedodontist busily executing treatment plan. Fear and anxiety associated with dental treatment are well recognized factors and have a negative impact on patient's willingness to get dental treatment (Speirs AF *et al*, 2001; Kaur R *et al*, 2015). Inability to effectively communicate with the dentist during the procedure adds to the child's already existing fear and anxiety. To bridge this inevitable gap of communication, a Novel Audio Sensory Video Interface device (AuSVIn) which is an android based application has been developed indigenously.

Corresponding author:* **Gandhi Henal Alpesh
Department of Paedodontics and Preventive Dentistry JSS Dental College and Hospital (constituent college) JSS Academy of Higher Education and Research Jagadguru Sri hivarathreeshwara UniversityJSS Medical Institutions Campus Sri Shivarathreeshwara Nagar Mysuru-570015 Karnataka, India

Rendering additional, positive experience for a child during dental procedures is also one of the major objective of the paediatric dentist. Various behavior guidance techniques have been adopted, among which distraction is a very effective method of diverting the child's attention from what may be perceived as an unpleasant procedure (AAPD, 2012; S. Nuvvula *et al*, 2015). Distraction can either be active or passive; active forms promote a child's participation involving several sensory components such as interactive toys, virtual reality, controlled breathing, guided imagery and relaxation (Perez B and Gluck GM,1999; Patel A *et al*, 2006; Weydert JA *et al*, 2006; Nilsson S *et al*, 2009; Bidarra R *et al*; Attar RH and Baghdadi ZD, 2015) whereas passive forms achieve distraction through a child's observation of an activity or stimulus like listening to music, watching a video or television, audio visual eyeglasses (Aitken JC *et al*, 2002; Marwah N *et al*, 2005; Prabhakar AR *et al*, 2007; S Nuvvula *et al*, 2015 ; Bidarra R *et al*). Video component of AuSVIn acts as a passive distracter whereas the whole application per say acts as an active distracter.

Studies on communication between dentist and patient are commonly restricted to interactions during the consultation period. However, there is no data regarding communication during the treatment procedure in paediatric setup, which is the crucial point of communication breakage. The present study deals with the scientific evidence to support the claim of patient distraction-enhanced co-cooperativeness; as well as a tool for communication even with the patient's innate inability of communication and compare it with the conventional hand gesture method during the procedure. For this we set up an interdisciplinary research team consisting of Paedodontists, IT professional, application designer, and user experience experts. As far as we know, this is the first intraprocedure communication cum distraction aiding application purposefully designed from the outset for deployment in a paediatric dental setup and dentist context.

About AuSVIn

It's an android based application. (Java version 2.1.2)

Audio Sensory Interface: The application is designed such that the child can record the basic messages prior to the start of the procedure through an attractive and child friendly recording page, assisted by the paedodontist and the parent. The child can then play the pre-recorded message to the paedodontist during the dental procedure by clicking on the respective icon on the screen, to communicate his feelings and requirement without having to interrupt the procedure. The messages recorded are that indicating pain, need to spit intra-operatively, message to pause the procedure, one indicating patient's wellbeing.

Video Sensory Interface: The child can select the video of choice which includes both educational and entertaining videos with children's favorite cartoon characters prior to the procedure from video gallery in AuSVIn. This Video will then play in the background with the expressive icons for communications placed in the foreground. The video component aids in passive distraction during the procedure.

Communication Interface: the Icon with the pre-recorded messages act as an interface as it helps in bridging the communication gap between the child and the paedodontist during the dental procedure. (fig.1)

Fig 1 Patient using AuSVIn for intraprocedural communication during LA administration

Other features of AuSVIn include

1. Patient's feedback can be recorded in the pre-loaded form with 5 sets of questions to check patient's acceptance. An attractive 5 point visual analogue scale is used for the feedback recording.
2. Patient data and feedback can be transferred to excel format directly from the application for statistical purposes.
3. Patient data including personal and clinical work record can be saved for future references and medico legal purpose.

MATERIAL AND METHOD

Prior to the start of the study, ethical clearance was obtained from Institutional Ethical Committee and written informed consent and assent was obtained from all the parents and the children participating in the study and the study was carried out in accordance to the Helsinki Declaration of 1975, as revised in 2000.

Study consisted of 14 subjects. Participants were selected on an out-patient basis considering the following eligibility criteria:

1. Of age group of 8-10 years.
2. With no previous dental experience.
3. Without any systemic, mental disorders and/or communicative disorders.
4. With bilaterally carious teeth indicated for extraction.
5. With Frankel's behavioral rating of "Positive" and "Definitely positive."
6. Patients and parents who have willingly signed the informed assent and consent.

Study Design

Parallel split-mouth study design was used in this pilot trial wherein every child will be compared to himself/herself with two different modes of communication in separate appointments spaced one week apart. The child here acts as his own control.

Randomization

The modes of communication was labeled as Conventional hand gesture based communication and AuSVIn based Communication. SNOSE technique i.e. Sequentially Numbered Opaque Sealed Envelopes were used for allocation

and concealment for the selection of the mode of communication to be used in the subjects on the day of the dental procedure. Senior faculty of the department prepared and delivered the sealed envelopes to the child from which the chosen envelope was opened to select the mode of communication for the first dental procedure.

METHODOLOGY

After allocation of the mode of communication i.e. either AuSVIn or conventional hand gestures, extraction was performed. Prior to the use of any mode of communication, instructions were given to the child as to how to use the allocated mode of communication during the procedure. In case of Hand gestures, pictorial representation of the hand gestures for different message communication was shown and demonstrated to the patient. Patient was made to practice the hand signs prior to the procedure. Similarly, use of AuSVIn was explained to the child, messages were recorded prior to the procedure by the child. The first procedure was followed by a washout period of one week before the cross arch procedure which was performed in the second appointment in which the other communication mode was assessed.

To record the patient's response objectively, a biometric record of patient's heart rate was done. Each child's heart rate was monitored during the treatment at different intervals with a pulse oximeter clipped to the finger of a child's left hand (for right-handed patients) (Attar RH and Baghdadi ZD, 2015). Heart Rate was measured during following intervals:

1. Baseline- after the patient sits on the dental chair for the procedure instructions on how to use the allocated mode of communication was given. After this the heart rate was recorded.
2. Injecting L.A.- during the first prick while injecting local anesthetic.
3. Forcep application- at the time of application of forcep.
4. Five minutes post procedure with the child on the dental chair
5. Intra-operatively: Every time the patient communicates with the dentist using the allocated mode of communication.

At The End of the Study, the Child Was Asked to Fill the Feedback Form Which is A Part of the Application To Check the Following

1. Ease of use.
2. Experience.
3. Accuracy in communication.
4. Comfort and logistics.
5. Preference.

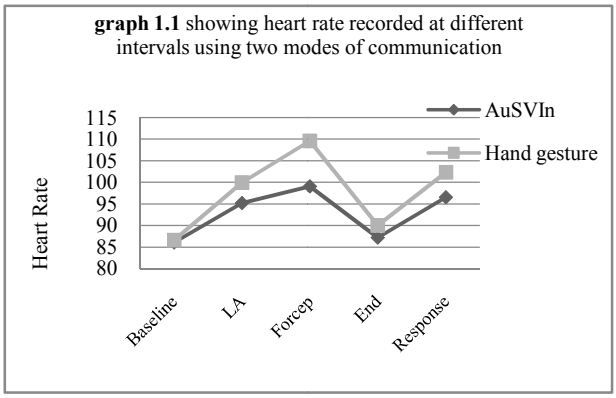
RESULTS

Statistical analysis

Paired t test was used to compare the heart rate scores. The analysis was done using SPSS 22 software. p values less than 0.05 were considered statistically significant.

Baseline heart rates (Graph1.1) do not show any statistical significant difference between the groups suggestive of standardization. The behavioral rating as per frankel's scale also added to the standardization and is same for all the patients at baseline. (graph 1.2, table1) Statistically significant difference is seen in the mean heart rate during the entire procedure using both the modes of communication. Mean heart rate is consistently less in patients during the entire procedure when AuSVIn is used as a mode of intra-procedural communication. Thus, AuSVn is acting as an effective distracter alleviating anxiety throughout the procedure. Also, the most painful procedure during extraction is administration of local anesthesia, with the patient being most anxious during this step. There was statistically significant difference in heart rate during administration of local anesthesia between the different modes of communication. The patient was comparatively comfortable and less anxious during local anesthetic administration when AusVIn was used. However, the communication was not hindered with AusVIn during the entire procedure as the number of intra-procedural responses elicited remained consistently the same between the two groups. Post anesthetic response in terms of heart rate recorded during forcep application remained statistically insignificant with patients giving similar responses during the procedure in both the communication modes. (Graph 1.2, table1)

graph 1.1 showing heart rate recorded at different intervals using two modes of communication



Graph1.2 showing mean heart rate of two groups at different events and during the entire procedure

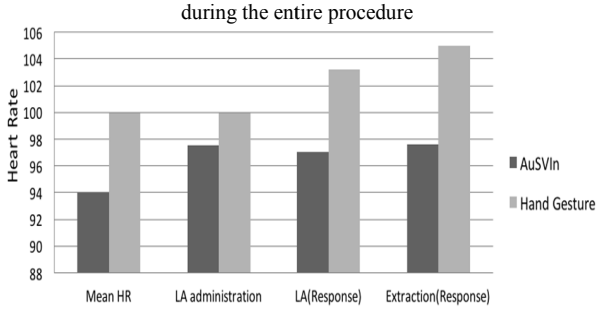


Table 1 showing comparison in the heart rate during different intervals and intraprocedural communication using hand gesture and AuSVIn as mode of communication between child and the paedodontist.

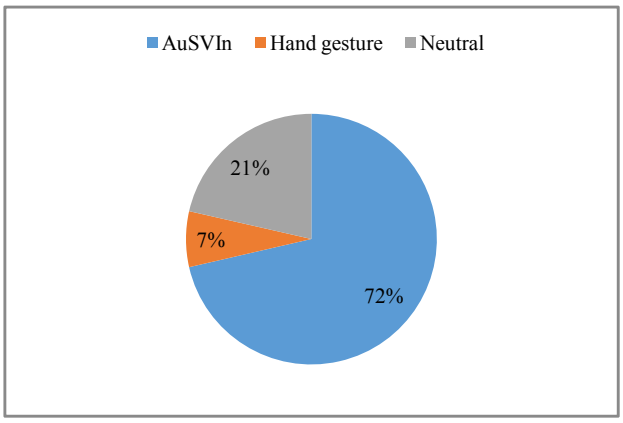
	Heart rate		t	Sig(2-tailed)
Mean heart rate(entire procedure)	Hand Gesture 96.52	AuSVIn 91.89	2.28	.040**
Baseline heart rate	86.57	86.07	1.102	.291
LA administration	99.93	95.21	2.288	.040**
Forcep application	109.57	99.07	1.564	.142
End heart rate	90.00	87.21	1.021	.326
Response during LA	103.21	97.08	2.174	.049**
Response during extraction	105	97.63	2.108	.05**

N= 14;**p<0.05 significant; paired t test

The (Graph1.2, table 1) shows the heart rate values during the patient's intra-procedural response. The Response heart rates

recorded in patients using AuSVIn consistently showed lower values as compared to that during conventional hand gesture responses. Though the nodal points at which the patient communicated were same while using both the modes of communication. The results are suggestive of comfort and consistency of patient communication using both the modes, wherein, using AuSVIn, communication was much more effective, comfortably done and with lesser anxiety and apprehension as compared to using conventional hand gestures.

The feedback recorded at the end of the procedure shows that more than 70% of the patients preferred AusVIn over hand gesture as a mode of communication for their further treatments. (Graph 1.3)



Graph 1.3 A pie chart showing patient preference for the mode of communication.

DISCUSSION

Dental procedures like extraction are often a source of anxiety and stress in children and adding to it is their innate inability to verbally communicate with the dentist during the procedure. Hence, it is important to use specific interventions to distract them from the treatment procedure without hampering the communication between the child and the paedodontist during the procedure. The innovation mentioned in the present study, AuSVIn, is assessed for its efficiency in aiding communication and role in alleviating apprehension through distraction, to claim with scientific evidence, its role as a tool in behavior management. Since every individual has a different pain threshold, the present study was designed as a parallel split-mouth intervention, so that each individual would be compared with themselves using AuSVIn as compared against conventional hand gesture as intra-procedural mode of communication.

Literature shows that Audio and Audio-Visual distraction is effective in reducing the anxiety, pain and fear during dental treatment (Prabhakar AR *et al*, 2007; Florella M *et al*, 2010 ; Kuar R *et al*, 2015 ; S Nuvvula *et al* 2015 ; Attar RH and Baghdadi ZD, 2015 ; Al-Khotani A *et al*, 2016) but it may interfere with the communication between the child and paedodontist during the procedure. The results of the present study show that the video component of the application acts as a passive distracter and the application as a whole acts as an active distracter thereby reducing the anxiety levels. The child's attention will be focused on the video, moreor less drained from the surrounding and hence leaving less attention available to process what is happening during the procedure without hampering the communication.

Heart Rate which according to many studies (Mccarthy FM, 1957; Guinot JF *et al*, 2011; Kuar R *et al*, 2015; Attar RH and Baghdadi ZD, 2015) is considered to be a reliable and safe indicator for stress, anxiety and response to stimulus served as an objective measurement tool in the present study. Though increase in heart rate was seen especially during local anesthesia administration, the degree of increase remained low with AuSVIn. The findings regarding the increase in heart rate followed the same pattern with the response time readings. The patient responded evenly while using both the modes of communication, but the heart rate increase was less when AuSVIn was used as compared to hand gestures. These values suggest the dual role of AuSVIn that is an effective distraction and a convenient communication interface.

Studies have been done emphasizing importance of effective communication inter-appointments or during consultation, but, there is no literature on the mode of communication used during dental procedure between the child and the paedodontist when its required the most. Hand gestures have been used conventionally in clinical set up since time immemorial. The statistical significance found in the biometric data during response suggests that the patient was able to communicate much more effectively and comfortably using AusVIn than hand gestures.

A child's age and maturity should also be taken into consideration while using any form of distraction or communication. Children at different developmental stages respond with different defense mechanism and coping strategies to stress (Patel A *et al*, 2006; Attar RH and Baghdadi ZD, 2015).We have taken the age group of 8-10 years since taking into consideration the learning cycle, as it is easier for the older children to understand how to use such applications and hence they will be benefitted more than the younger age group. Further research is required to examine the moderating effect of distraction and effective communication of AuSVIn in younger age groups.

CONCLUSION

Communication is about being effective, not always about being proper. AusVIn has the potential of being not only an effective distracter but also an efficient and effective mode of communication between the child and the Paedodontist. It is rightly said by George Bernard Shaw "The single biggest problem in communication is the illusion that it has taken place". AuSVIn acts like a pavement for clear communication, by expression of emotions perceived clearly by the dentist thus rooting out the illusion.

Acknowledgement

None

Conflict of interest

None

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