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Assessment of the effectiveness of using a mixed reality gaming app as a non-pharmacological behaviour management technique.

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Abstract

Introduction: Dental fear is very common and inevitable when it comes to treating children's teeth as it involves LA administration, exposure to loud sounds of airotors, suctions and the presence of bright lights which make the children more anxious and stressed. Various behaviour management techniques have been used to deal with the child's dental anxiety. Mixed reality is a new technology which can be used as an effective distraction technique. Using a game, which enables the users to interact with the virtual objects in real time, we can gain their attention towards the game thus distracting them during the dental procedures.

Aim: To evaluate the effectiveness of using a mixed reality gaming app as a non-pharmacological behaviour management technique.

Methods: A mixed reality maze game was developed using Unity software. Thirty children in the age group 6-12 years were enrolled in this study, they were further divided into 2 groups of 15 each (Group 1- Control group, Group 2- Study group). Using the Facial image scale their anxiety level was noted before and after the treatment.

Results: The participants in the study were in the age group of 6- 12 years. Comparison between the means of Facial Image scale scores before & after treatment in the Study & Control group using the Wilcoxon Signed Rank Test showed the mean difference as 2.53 in the Study

group and 1.47 in the Control group which was statistically significant at P<0.001.

On Comparison between the mean percentage of Reduction in Facial Image scale scores after treatment in the Study & Control group using Mann Whitney Test revealed a mean difference of 24.22 which was statistically significant at P=0.002.

Conclusion: This gaming app can be used as an effective way of behaviour management in children, since this app can be used on the phone it is convenient with minimum armamentarium.

Keywords: Gaming App, Mixed Reality, Non-Pharmacological Behaviour Management Technique.

Introduction

Successful treatment and management of children during dental procedures depend on the skills of the dentist to understand the patient and relieve their anxieties and fears. The concept behind guiding a child's behaviour is treating their dental fears and anxieties rather than just operating on the tooth alone. The aim of the Pediatric dentist should not only be, the treatment but also to create a positive attitude towards the dental healthcare field, which will in the future help them maintain proper oral and general health.

A variety of behavioural management techniques (BMT) are used based on the child's age, type of fear, level of anxiety or stress. Hence an appropriate technique should be chosen for the benefit of each child patient. There have been advances in BMT based on the need of the patient. Digital access has led to the birth of a generation called as "digital natives" they are individuals who are born immersed in digital technology and look for new content & activities that might encourage them to study, learn or perform a task more easily.[1]

Latest behaviour management techniques include the use of virtual reality, augmented reality and mixed reality. Mixed reality is a combination of virtual reality and augmented reality.

When users can interact with both virtual and real objects in real time, while simultaneously, these objects can interact with each other it is called as Mixed Reality. This "environment awareness" implies that not only do virtual objects act in the real environment, but real objects can also modify the virtual elements, regardless of where the experience is taking place.

This study uses mixed reality, the latest technology to develop a maze game which will act as a distraction technique in the behaviour management of a child undergoing the dental procedure.

Material and methods

Inclusion criteria

1. Children in need of dental treatment under local Anesthesia
2. Patients first dental visit
3. Children between 6 to 12 years of age
4. Children with no relevant medical conditions
5. Children with Frankl's Rating Scale 1 & 2. B.

Exclusion criteria

1. Children with previous dental experience.
2. Children with any visual defect.
3. Children with any auditory defect.
4. Mentally or physically challenged child. 5. Children with learning disabilities.

A mixed reality, maze game was developed using Unity software. Thirty Children in the age group 6-12 years, visiting the department of paediatric and preventive dentistry, P.M.N.M dental college and hospital, with a Frankl Rating scale of 1,2 who had to undergo dental procedures under Local Anaesthesia were included in this study. They were divided into 2 groups of 15 each using the lottery method. (Group 1-Control group, Group 2- Study group)

- Group 1- Subjected to Tell Show Do (TSD) technique as a behaviour management method.
- Group 2- Subjected to mixed reality maze game as a distraction and behaviour management method.

Anxiety levels were evaluated before the procedures using Facial Image scale. In the Control group, Tell-Show-Do behaviour management technique was used. The Tell-Show Do technique was carried out using appropriate euphemisms to describe the airotors, syringe, cement carrier, restorative cement and suction. TSD technique was standardized and the operator was trained for the same.

Cut out of the printed maze game was given to the child in Group 2 [Fig1], using the help of an assistant the mobile is held in such a manner that the child sees the maze through the mobile [Fig2]. Here the 2D image appears as 3D in the mobile application, and the static ball on the maze cut out when rotated, moves along the maze walls, this is based on the gravity principle. The child is engaged in the game while the procedure is carried out [Fig 4].

After the procedure is done on both groups, the children are again evaluated for their anxiety levels using a Facial Image scale. [Fig 3]

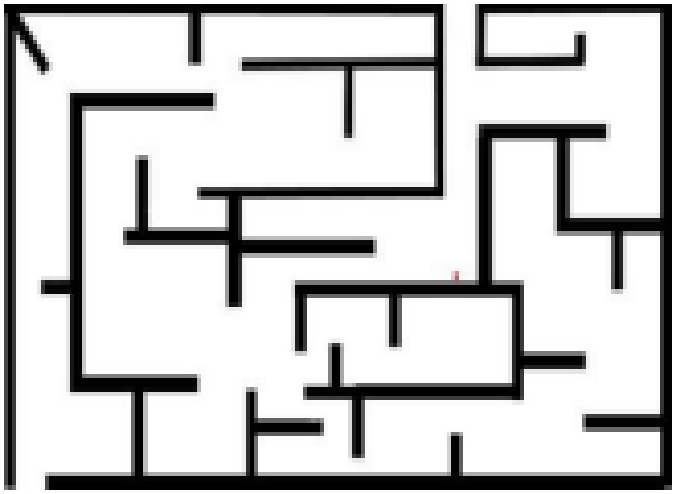


Fig 1: Cut-out of a maze.

Fig 2: view of the cut-out through the mobile application.

Fig 3: Recording anxiety Scores using facial image scale.

Fig 4: Using mixed reality maze gaming app during the dental procedure.

Results

In this study, the participants were in the age group of 6-12 years [Fig5] and Comparison of mean Facial Image scale scores between before & after treatment in the Study & Control group using the Wilcoxon Signed Rank Test showed a mean difference of 2.53 in the study group and 1.47 in the control group which was statisti cally significant at P<0.001 [Fig 6].

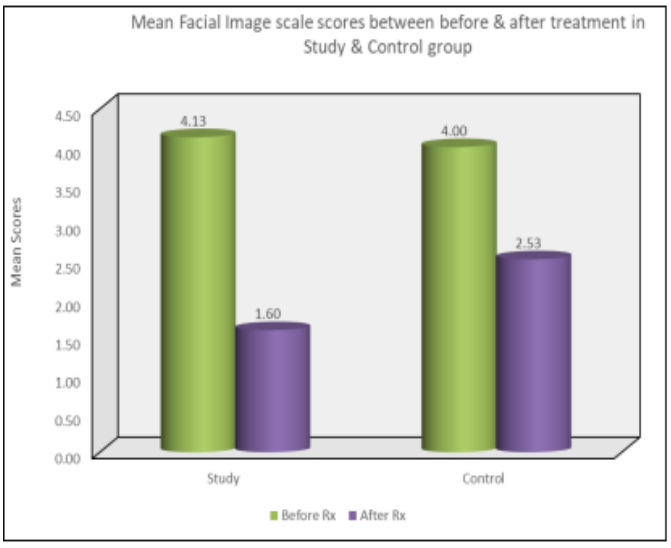
On Comparison between Study & Control group after treatment, the mean % of Reduction in Facial Image scale scores using Mann Whitney Test revealed a mean difference of 24.22 which was statistically significant at p 0.002 [Fig 7].

Table 1: Age and gender distribution between Control and Study.

Age and gender distribution between 2 groups						
Variable	Category	Study		Control		P-Value
		Mean	SD	Mean	SD	
Age	Mean	8.47	2.07	8.40	1.84	0.93[a]
	Range	06 - 12		06 – 12		

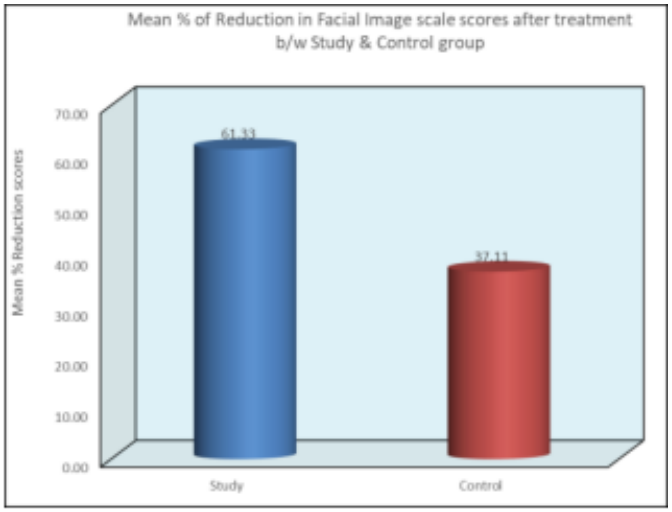
Note: a. Mann Whitney Test; b. Chi square Test.

Fig 5: Comparison of mean Facial Image scale scores between before & after treatment in Study.



* - Statistically Significant.

Fig 6: Comparison of mean % of Reduction in Facial Image scale scores after treatment b/w Study & Control group.



Discussion

Dental anxiety is a major problem leading to difficulty in managing children in the dental clinic. It has been observed that the effects of anxiety, have persisted even into adulthood, which results in dental negligence and eventually deterioration of oral health. It is important that dentists detect dental anxiety in child patients and modify it as early as possible using various behaviour management techniques.

Mixed reality is in trend and it is being used in modern dentistry because of its impact on changing the patient's experience. It is a mixture of physical and digital world, enabling the user to interact with the digital object in real time and vice-versa. It differs from Augmented and Virtual reality. Augmented reality is the experiences that overlay digital or virtual object in the real time, whereas the experiences that occlude the view to present a fully immersive digital experience is virtual reality. The transition between augmented and virtual realities forms mixed reality, where you can place a digital object in the physical world as if, it is physically present in real time.

This study pivots a behaviour management technique with an interactive mixed reality gaming mobile

application, specially designed for this context and purpose. A mixed reality, maze game is developed using Unity software. The age group of 6 - 12 is chosen since the concrete operational stage occurs between the ages of 6 and 11 years. During this stage, a child develops the ability to think logically and solve problems.

The facial image scale (FIS) comprises a row of five faces ranging from very happy to very unhappy. The children were asked to point at which face they felt most like at that moment. The scale is scored by giving a value of one to the most positive affect face and five to the most negative affect face.

The anxiety levels were evaluated using the facial image scale (FIS) which consists of a row with five faces ranging from very happy to very unhappy. All the children in the study were asked to point at which face they felt most like at that moment. The scale is scored by giving a value of one to the most positive affect face and five to the most negative affect face.9

Results in this study show that on comparison between the means of Facial Image scale scores in the Study group, before & after treatment was significantly reduced, suggesting the reduction in the anxiety levels of children in study group after using mixed reality maze game.

This study highlights that both Tell-Show-Do and mixed reality maze game showed significant reduction in anxiety levels but on comparison of both the groups the Study group (mixed reality maze game) was more effective.

The limitations of the study include less sample size, the need for longer engaging games, evaluation of anxiety was of self-report type and there were chances of movement of the child during treatment.

Conclusion

This gaming app can be used as an effective distraction and behaviour management technique in digitally native children. The mobile application can be used without much armamentarium, making it more convenient.

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