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Do positive distractions improve pediatric patient satisfaction in children undergoing medical procedures?

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ABSTRACT

OBJECTIVE: The objective of this selective EBM review is to determine whether or not positive distractions improve pediatric patient satisfaction in children undergoing medical procedures.

STUDY DESIGN: Systematic review compiling data from two randomized controlled trials and one convenience prospective trial between 2012 and 2015, all in the English language.

DATA SOURCES: After a thorough search of PubMed and Cochrane, three pertinent studies were found to include in this review. The selected studies were evaluated to assess the effectiveness of positive distraction techniques in improving pediatric patient satisfaction.

OUTCOMES MEASURED: Decrease in anxiety and pain symptoms measured by the Yale preoperative anxiety scale, behavioral observation and self-reported assessments were assessed.

RESULTS: Each of the selected studies found that the use of positive distraction techniques resulted in lower anxiety, stress and pain levels for children who were given a positive distraction technique, when compared to the children who were not exposed to a distraction technique. Lee et al. observed that children who viewed an animated cartoon exhibited lower anxiety levels in the operating room ($p<0.001$). Quan et al. concluded the treatment group who did not have a positive distraction technique of lights or visual distractions, exhibited higher stress throughout the radiology procedure ($p<0.001$). The Downey et al. study assessed there was a significant difference between the children who viewed a cartoon compared to the children who underwent a standard medical procedure, and showed significant with an F value of 5.523, significant at 0.021.

CONCLUSIONS: The results of these studies demonstrated that the use of positive distraction techniques in the pediatric population is an effective method to alleviate stress, pain, and anxiety for children undergoing a medical procedure. These interventions have shown to improve a child's overall satisfaction towards medical procedures.

KEY WORDS: distraction, children, pediatric, positive distraction intervention

INTRODUCTION

Pediatric patients are often faced with debilitating anxiety, fear and stress when experiencing various medical procedures in differing settings.[1] Many of the stressors associated with medical procedures can cause unnecessary anxiety, fear that can adversely affect the patient's response to his or her overall experience in the medical setting.[1] In addition to potentially suffering from emotional and psychological disturbances, many children are often given analgesics and sedatives that could have otherwise not been administered if their adverse reactions (crying, hyperventilating, anxiety, and high blood pressures) were better controlled. While there have been various approaches to help a child's experience in a medical setting, this paper evaluates the efficacy of positive distraction techniques for improving possible anxiety and fear that pediatric patients my face when enduring medical procedures.

In 2012, 5.9 million children were hospitalized in the US; additionally, pediatric patients were seen in an ambulatory setting on average of 31 times from birth to age 21.[2] Although there is not an exact number available of pediatric patients undergoing medical procedures in the US, in 2006, about 26.4 million visits in the emergency department were patients under the age of 18.[3]

Pediatric patients undergo medical procedures that are often associated with a high level of fear, stress and preoperative anxiety, resulting in increased incidences of psychological and negative outcomes.[1,2] Studies have shown that children have a lower capacity to handle anxiety compared to adults; as a result, children are more often to be uncooperative throughout medical procedures, ultimately increasing the risk for postoperative pain.[4] An exact number for the total healthcare cost of preventative measures to help alleviate the stress associated with healthcare settings in the pediatric population has not been identified, however; one database

stated the annual cost for a pediatric outpatient MRI in with anesthesia was approximately $1,116.[5]

It is well understood that children who often face more preoperative anxiety have been associated with more agitated behaviors when undergoing medical procedures.[4] Studies have shown that pediatric patients can be distracted by a familiar toy or positive environmental distractions that may lead them to disregard verbal and tactile stimuli, alleviating anxiety states when in the medical setting.[1,2] While positive distractions have commonly been utilized in creating a more amicable space for children in the medical setting, it is still a novel approach to utilize positive distractions in the setting of common medical procedures.[6]

The mainstay treatments for alleviating pediatric pain and anxiety during medical procedures includes sedative medications, and less commonly behavioral and environmental interventions.[7] Sedative premedication have been the primary source for improving a pediatric patient's overall procedural experience.[7] Midazolam, clonidine, and ketamine are commonly used in the pediatric population.[7] While these treatment options have been the mainstay approaches to alleviate stress and pain in the pediatric population during medical procedures, sedative medications have been associated with the risk of severe side effects, such as respiratory depression, and prolonged recovery time.[8]

An alternative approach to improve pediatric patient satisfaction while undergoing medical procedures has been the use of positive distractions. This intervention utilizes visual, auditory, or toy distractions, to improve the overall pediatric patient response towards routine medical procedures. This approach may improve the many negative behaviors (stress, anxiety, fear) associated with medical procedures in the pediatric populations, and may help lower the use of sedative medications. This paper analyzes two randomized controlled and one prospective study

to assess the effectiveness of positive distractions throughout a medical procedure for the pediatric population, to ultimately improve a child's experience and satisfaction in the medical setting.

OBJECTIVE

The objective of this selective EBM review is to determine whether or not positive distractions improve pediatric patient satisfaction undergoing medical procedures.

METHODS

The studies utilized in this review were two retrospective cohort studies and one prospective study. The patient populations in the studies included boys and girls ages 3 to 18 years who underwent medical procedures. In all three studies a positive distraction technique (behavioral or environmental stimuli) was selected as the intervention. The comparisons in the studies ensured all treatment groups participated in one positive distraction technique (behavioral or environmental) and the control group had no positive distraction techniques; however, the type of positive distraction utilized differed in each study. Outcomes measured included the Yale preoperative anxiety scale to measure anxiety levels, verbal behaviors with visual scales, and a self-reported assessment of satisfaction of care using a face scale.[1,4,9] Each article was published in English in peer-reviewed journals, and all were published between 2012 and 2015. Articles were found using key words including "distraction", "children", "pediatric", and "positive distraction intervention". The articles were found via the PubMed database; in addition, Cochrane systemic review searches were also completed to exclude any other previous systemic reviews on this topic.

Articles were selected on relevance to the clinical question and ensured the application of a patient-oriented outcome. The major inclusion criteria consisted of at least two of the studies

being randomized controlled trials in peer reviewed journals, published within the past fifteen years and included children ages 3-15 years of age who had undergone a medical procedure. Studies that were excluded were those with patient populations greater than 21 years of age, with children with a history of cerebral palsy with scoliosis, with patients under the age of 3, and with any unstable or nonconsenting patients.[1,4,9] The statistics utilized in the studies are p-values, F-score and a mean change from baseline.[1,4,9]

Table 1-Demographics and characteristics of included studies

Study	Type	# Pts	Age (yrs)	Inclusion Criteria	Exclusion Criteria	W/D	Interventions
Lee[4] (2012)	Randomized Controlled Trial	130	3 to 7 years	Age 3-7 children undergoing anesthesia for elective surgery	Emergency surgery, previous anesthetic experience, developmental delays, retardation or chronic illnesses	4	Viewing an animated cartoon or playing with a toy in the OR before anesthesia induction.
Quan[1] (2016)	Randomized Controlled Trial	213	4-18 years old	Pediatric patients 4-18 years old	Cerebral palsy patients with scoliosis, patients under 4 years old	15	Two out of five radiography rooms had positive environmental distractions (color lights, music and wall projection).
Downey[9] (2012)	Prospective study	110	3 to 18 years old	Age 3-5 and 6-18, with acute pain in ED and required a procedure	Unstable or nonconsenting patients	10	2 groups, those who watch cartoons during procedure and those who would not.

OUTCOMES MEASURED

In all three studies, anxiety level, verbal behaviors, and pain rating were measured by using varied methods of questionnaires and interviews: The Yale preoperative anxiety visual scale (mYPAS), mood state scales, and self-reported assessments.[1,4,9] Lee et al. utilized the Yale

preoperative anxiety in which the patients' baseline anxiety were measured pre-operatively and their activity, emotional expressivity, state of arousal and vocalization were evaluated.[4] The Quan et al. study assessed both objective (video recordings, medical records) and subjective data (mood state scales and questionnaires) to compare environmental distraction techniques in three positive distraction environments of lights and animation.[1] Downey et al. utilized a self-reporting and visual analog scale to assess pain perception utilizing the viewing of cartoons.[9]

RESULTS

This systemic review analyzed two RCTs and one prospective study to determine if positive distractions such as playing with a toy, visual or environmental distractions can help alleviate a child's overall anxiety and pain state during a medical procedure, improving their overall satisfaction. Each study consisted of a group with a positive distraction, and a control group with no distraction. In all three studies reviewed, there were no adverse effects noted in these studies, and no issues regarding tolerability were noted.

The Lee et al. study included 130 children ages 3 to 7 years who received general anesthesia for elective surgery.[4] These children were randomly selected to compare the effects of 2 behavioral interventions on preoperative anxiety.[4] The children were then randomly split through a computer generator and each child was split into 1 of 3 groups: group 1 (control), group 2 (toy), group 3 (animated cartoon).[4] Exclusion criteria for the study included patients who needed emergency surgery or had previous anesthetics experience, developmental delays, or chronic illnesses.[4] Inclusion criteria included children ages 3 to 7 years undergoing anesthesia for elective surgery.[4] The participants were all in a surgical setting presenting for elective surgery, the most common being tonsillectomies.[4] From the 130 enrolled children, data from 4 children from group 2 were not used because the participants did not bring in a toy.[4] Data from this study

was reported as p-values, and data was converted to dichotomous form.[4] No participants were lost to follow up.[4] Lee et al. utilized the MYPAS scale to measure the children's anxiety levels through their activity, emotional expressivity, state of arousal, vocalization, and use of their parents.[4] The findings showed that the anxiety levels of the children in group 2 were significantly lower than that of the children in groups 1 and 3.[4] In the operating room, the children in group 3 had the lowest anxiety scores when compared to the other groups ($p<0.001$).[4] 43% of the children in group 3 showed no anxiety in the OR, while 7% of group 1 and 23% of groups 2 showed no anxiety.[4] Positive interventions correlated with a relative risk reduction (RRR) of 5.14, absolute risk reduction (ARR) of 0.36, and number needed to treat (NNT) of 2.77 rounding to 3 (Table 2).[4] This indicates only 3 patients need to be treated with either an animated cartoon or toy to lower the anxiety throughout the medical procedure, in order for one added patient to have lower anxiety levels.[4]

Table 2—Number needed to treat calculations using Lee et al.[4]

CER Control event rate	EER Experimental event rate	Relative risk reduction (RRR) $\frac{EER - CER}{CER}$	Absolute risk reduction (ARR) EER - CER	Number needed to treat (NNT) 1/ARR
0.07	**0.43**	**5.14**	**0.43-.07 = 0.36**	**1/0.36 = 2.77 ~ 3**

Quan et al. conducted a RCT involving 213 pediatric patients ages 4-18.[1] Out of the cohort, children were randomly assigned to three different radiography rooms.[1] Children with a prior diagnosis of cerebral palsy or scoliosis and patients under the age of 4 were excluded, while inclusion criteria included pediatric patients 4-18 years old who visited the two radiography rooms during the study period (September-November 2012).[1] Out of a total of 213 patients, 15 patients were missing data including the surveys or scales.[1] In addition, it was self-reported by

the parents that 16 children were not randomized due to those children choosing the room themselves.[1] As a result, 182 children who were randomized and complied were analyzed for the study.[1] Data from this study compared mean percentages and ANOVA was the statistical test utilized.[1] The patient population was divided into 4 groups: a control group with no positive distractions, a low positive distraction group, a medium positive distraction group that had lighting only in the room, and a high positive distraction group that had animation and light in the rooms.[1]

Quan et. al concluded that the low positive distraction group exhibited the highest stress coping behaviors, when compared to the other groups, indicating that this group experienced higher stress throughout their radiology study procedure.[1] The mean for the low positive distraction group exhibiting distressing behaviors was 78.8% compared to 58.1% and 64.6%% for medium and the high positive distraction groups, respectively.[1] The p-value concluded to be <0.001 indicating a significant difference between the groups (Table 3).[1] Follow-up of the patients were not reported.[1] The adverse side effects of stress responses from the children in this study were considered; however, due to radiography procedures taking less time, studies have shown that they have been proven to be "less stressful than other medical procedures".[1]

Table 3—Results from Comparison of Means[1]

Comparison of Means: Proportion of verbal Low stress/coping behaviors	Hypotheses testing: ANOVA
Low positive distractions: 78.8% **Medium positive distractions:** 58.1% **High positive distractions:** 64.6%	p<0.001

The Downey et al. study conducted a convenience prospective study was completed for 1 year, and included 110 children ages 3-5 and 6-18 years of age for the study.[9] Exclusion criteria

consisted of unstable or nonconsenting patients.[9] Inclusion criteria included patients 3 to 5 and 6 to 18 years of age presenting to the emergency department that required a medical procedure.[9] In this study, out of the 110 children, six children did not complete the planned procedure, and four did not cooperate; therefore, they were excluded from the study.[9] 100 children were compliant with the intervention of watching a cartoon or not watching a cartoon.[9] This study was conducted in a community teaching level I pediatric and adult emergency department.[9] This study analyzed the treatment effect by an F-score, and level of significance was determined by $p<0.05$.[9]

According to Downey et al. there were significant differences between the mean pain levels between those who were shown and not shown cartoons, the F value was 9.268, significant at 0.03 with an α set at 0.05 or less to be considered significant.[9] The largest difference between the two groups was the mean pain levels before the procedure with the group that watched a cartoon compared to the group that did not watch the cartoon, at an F value of 5.523, significant at 0.021 (Table 4).[9]

Downey et al. concluded that cartoon viewing in an acute setting can change a pediatric patient's perception of pain, when assessed 5 minutes before the procedure.[9] Patients that viewed the cartoon in the study were able to tolerate the additional distraction technique, and there were no adverse events indicated in the study.[9]

Table 4—Significant results from mean pain levels within subject effects[9]

Results α 0.05 or less*	**F value**	**Significance**
Overall difference in pain within subject effects	F_1= 9.268	0.03
Difference between the subjects pain before the procedure	F_1= 5.523	0.021

DISCUSSION

This systemic review of all three studies highlighted the results of utilizing positive distractions for pediatric medical procedures. All three reviews appear to validate the use of positive distractions in pediatric medical procedures. In the Lee et al. and Quan et al. studies, results both showed a $p<0.001$, indicating there was a suggestive difference between the groups who were exposed to a distraction intervention, which resulted in overall lower anxiety levels and stress response.[1,4] In addition, the Downey et al. study concluded the use of cartoon visualization prior to a pediatric procedure can decrease the pain levels in pediatric patients.[9] The Downey et al. study revealed that patients who were watching a carton before and during the medical procedure had a significant difference between the control and treatment group at an $F_1= 9.268$, significant at 0.03.[9] No outliers were highlighted in the three studies.

As validated from the results and discussion above, the idea of providing positive distractions for the pediatric population through medical procedures has shown beneficial results. The National Health Interview Survey's Early Release Program reported in 2016 that 5.1% of children under the age of 18 continue to be uninsured in the United States.[10] This lack of access to care will continue to deter the uninsured pediatric population in the US from accessing quality care, and the opportunity of receiving positive distraction to help relieve any stress or anxiety associated with the procedures.[10]

Although the results of the three reviewed studies have shown promising results, there are areas of concern associated with the use of certain positive distractors. Other forms of positive distractors such as playing with a toy require a certain age, developmental level, and temperament in the child.[11] In addition, Koller et al. states that children who do not meet these

requirements, or prefer to observe an activity may not benefit with distractors in the medical setting.[11]

Areas of limitations in the three reviewed studies include the inability of completing a double blind RCT and the limited sample sizes. Although two of the studies reviewed were RCTs, a double blind randomized trial would provide more clear and non-biased results to help validate the reliability of the studies. The limited sample size for each study, often due to patients' incompliance or invalid data due to bias, was also a limitation in these studies. [1,4,9]

CONCLUSION

By analyzing the data of the various pertinent studies, it is evident that positive distractive interventions can alleviate stress and anxiety associated with pediatric medical procedures, ultimately improving their overall satisfaction and experience. With the alleviation of stress and anxiety that are commonly associated with medical procedure, positive interventions can improve a child's outlook and overall satisfaction with medical procedures. Although the Lee et al. results were considered significant, the use of an observer that was not double blinded for anxiety measurement of the children left room for bias and was a limitation for this study.[4] For future studies, a double blinded observer would provide more valid results. Future studies should be directed towards focusing on a more specific age in the pediatric population, due to the differing developmental levels and social skills between the pediatric age groups. The access and use of more positive distractors will provide a better patient satisfaction, and may decrease any negative stigma in children towards future medical procedures.

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