

**Contribution of Positive Reinforcement in Reducing
Children's Pain Responses during Vein-Puncture**

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Abstract:

Positive reinforcement occurs when a reward, sometimes called a reinforcer, is given for a specific desired behavior. It can be a tangible object, an activity, something sensory, or social. Pain is a subjective experience, and no objective tests exist to measure it. Vein puncture is one of the most painful medical procedures for a child, and it is one of the most frequently performed procedures. The study aimed to evaluate the contribution of positive reinforcement in reducing children's pain responses during vein puncture. Quasi experimental design was conducted for this study. It was conducted in the medical unit of El- Menuofyia and Tanta university hospitals. Eighty children's accompanied by a female care givers, were selected according to specific criteria. After collecting demographic data, the type of reinforcer was chosen after observation and interview. It was individualized according to children preference and motivation. It was consistently delivered after a desired behavior. Reinforcer was administered immediately after a desired behavior, and after simple explanation for to the child. Data collection regarding pain was started after 4 consecutive use of positive reinforcement of a desired behavior in other procedures. Reinforcer was used to observe children' pain during vein puncture and to evaluate the effect of positive reinforcement on children FLACC , Wong -Baker faces, heart rate and oxygen saturation. The caregivers "mothers" were involved in all steps of data collection. The result of the study showed that High statistical significant differences were found regarding FLACC Scale -Pain Assessment Tool- "Observer Rated Pain Scale and Wong Baker Scale before and after reinforcement. In relation to pulse and oxygen saturation there was statistical significant difference during vein puncture. According to the current study, it is recommended to replicate the study with a larger sample size in children undergoing other painful procedure. and developing an educational program for nursing staff to increase the skills of positive reinforcement of well or healthy behaviors of children..

Key Words: Positive reinforcement, children' pain, and vein-puncture

Introduction:

Reinforcement is a process in which a consequence," a reinforcer", is given following a desired behavior to increase the likelihood that the behavior will occur again under similar conditions. It is designed to be used systematically and contingently. Reinforcement is an essential condition for learning because reinforced responses are remembered. The term reinforce means to strengthen, and is used in psychology to refer to any stimulus which strengthens or increases the probability of a specific response. Reinforcement is a stimulus which follows and is contingent upon a behavior and increases the probability of a behavior being repeated. It can increase the probability of not only desirable behavior but also undesirable behavior.⁽¹⁾

We all apply reinforcers every day, most of the time without even realizing we are doing it, and this may increase the probability that the same response will be repeated. Positive Reinforcement is a safe and effective means of modifying and/or changing behaviors in children from toddlers to teenagers. There are many types of reinforcers; they should be selected based on their reinforcing nature for a given person and situation.⁽²⁾

Behavior is strengthened when there is an increase in its frequency, duration, intensity, or speed (decrease latency). A behavior that is strengthened through the process of

reinforcement is called an operant behavior. An operant behavior acts on the environment to produce a consequence and in turn, is controlled by, or occurs again in the future as a result of, its immediate consequence. The consequence that strengthens an operant behavior is called a reinforcer. Positive reinforcement refers the addition of a stimulus following an event. It is important to establish how frequently the reinforcement will be provided. Too frequent use of reinforcement may cause the individual to grow tired of the reinforcement and result in a loss of reinforcement effectiveness. Thus, arranging a schedule for when to use reinforcement and how often, is very critical.⁽³⁻⁵⁾

Positive reinforcement can be conducted through, behavior contract, that is widely used to change the behavior. It is a formal written agreement that spells out in detail the expectations of both the child and the caregiver in carrying out the intervention plan, making it is a useful planning document. Also, because the child usually has input into the conditions that are established within the contract for earning rewards, the child is more likely to be motivated to abide by the terms of the behavior contract. Token economy is also used to emphasize reinforcing positive behavior by awarding "tokens" for the

performance of the desired behavior. In this system, tokens are accumulated and exchanged for a reinforcer. Token economies and can use chips, tickets, points or any number of other things as the tokens. (4, 6)

Reinforcers may be Social, activity, exchangable "Token" or Tangible. Social reinforcers are socially mediated by teachers, parents, other adults, and peers which express approval and praise for appropriate behavior. Comments ("Good job," "I can tell you are working really hard," "You're nice"), written approval ("Super"), and expressions of approval (nodding your head, smiling, clapping, a pat on the back) are all very effective reinforcers. Activity Reinforcers, are very effective and positive for children allowing them to participate in preferred activities (such as games, computer time, etc.) is very powerful, especially if part of the reinforcement is being allowed to choose a person with whom to participate in the activity. Exchangeable Reinforcers (Tokens), involves awarding points or tokens for appropriate behavior. These rewards have little value in themselves but can be exchanged for something of value. Tangible Reinforcers, includes edibles, toys, balloons, stickers, and awards. (4, 7, 8)

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage. It is the most common reason for seeking health care. It

occurs with many disorders, diagnostic tests, and treatments. It disables and distresses more people than any single disease. Since nurses spend more time with the patient in pain than do other health care providers, Nurses encounter patients in pain in a variety of settings, including acute care, outpatient, and long-term care settings, as well as in the home. Thus, they must have the knowledge and skills to assess pain, to implement pain relief strategies, and to evaluate the effectiveness of these strategies, regardless of setting.⁽⁹⁾

There are no diagnostic tests that can determine the quality or intensity of an individual's pain. It is generally preventable only to the degree that the cause of the pain is preventable one of the three categories of pain established by the International Association for the Study of Pain, denoting pain that is caused by occurrences such as traumatic injury, surgical procedures, or medical disorders; clinical symptoms often include increased heart rate, blood pressure, and respiratory rate, shallow respiration, agitation or restlessness, facial grimaces, and splinting⁽¹⁰⁾

Pain management is considered such an important part of care that the American Pain Society coined the phrase "Pain: The 5th Vital Sign" to emphasize its significance and to increase the awareness among health care professionals of the importance of effective pain management.⁽¹¹⁾ Documentation of pain assessment is now as

prominent as the documentation of the “traditional” vital signs. Pain assessment and management are also mandated by the Joint Commission on the Accreditation of Health care Organizations⁽¹²⁾

Venipuncture is a medical term used to describe the act of puncturing a vein, whether to draw blood or to insert an intravenous, or IV, catheter. It can be performed using butterfly needles, an IV catheter, or a simple needle attached to a blood collection tube. It is the process of obtaining intravenous access for the purpose of intravenous therapy or for blood sampling of venous blood.⁽¹⁰⁾ Venipuncture is one of the most routinely performed invasive procedures and is carried out for two reasons, to obtain blood for diagnostic purposes or to monitor levels of blood components. Blood analysis is one of the most important diagnostic tools available to clinicians within healthcare. Its data is relied upon in the clinical setting for interpretation of a myriad of clinical signs and symptoms and developing skills in vein puncture can facilitate holistic and timely treatment.⁽¹³⁾ Repeated vein puncture is an especially stressful and painful experience for children. Venipuncture that, involve rough treatment, poor preparation or unbearable pain can have extensive effects that include anxiety, decreased pain threshold, reduced effects of analgesia for further procedures and avoidance of medical

care. Anxiety and fear during vein puncture also reduce cooperation from the child resulting in repeated attempts at carrying out the procedure.⁽¹²⁻¹⁵⁾ The behavior of children during invasive procedures is widely individual, and dependent on degree of perceived pain. Perception of pain is affected by emotional and situational factors. It also varies according to age, sex, cognitive level, temperament, culture, parental support, and other situational factors such as previous experience with painful procedure, suppression/alleviation of pain using either pharmacologic or non-pharmacologic means.⁽¹⁴⁻²⁰⁾

Positive reinforcement is one of the behavioral interventions used as non-pharmacological therapy to relieve pain. This involves praising the child for being brave during a procedure, surgery, or while healing from an illness. Rewards, like toys, games, stickers, or other trinkets may also be used. Reinforcers are often used because of their immediate power to modify behavior. This power comes from the fact that they are of direct biological importance to the organism. Food, water, exercise, and escape from pain can be considered as primary reinforcers because a lack of these can be physiologically harmful and/or painful. Reinforcement is the most important principle of behavior, and a key element of most behavior change programs. It is the process by which the behavior is

strengthened, if a behavior is followed closely in time by a stimulus and this results in an increase in the frequency of that behavior in the future. ^(21,22)

Aim of the study

The study aims to evaluate the contribution of positive reinforcement in reducing children's expression of pain during vein-puncture.

Research question:

Is positive reinforcement reduce children's expression of pain during vein-puncture ?

Subjects and Method

Research Design:

Quasi-Experimental study

Materials:

Setting:

This study was conducted at the Inpatient Pediatric Medical Department at Menoufiya University Hospital and Tanta University Hospital .

Subjects:

The sample was consisted of 80 children accompanied by a female care givers. Subjects were selected according to the following criteria:

1. Age ranged from 3 to 7 years .
- 2 None of them was critically ill or mentally retarded.
3. Free from frequent pain .What do you mean

Tools of data collection:

Three tools were used for data collection: Questionnaire sheet, that was classified into three parts:

Part one: The Child Information Sheet

(CHILDIS): was used to record information about the child's gender, age, number of past hospitalizations, and number of past venipunctures and other painful procedures.

Part two: The Caregiver Information

Sheet (CIS) was used to record demographic information about the caregiver, including age, gender, marital status, education level, employment status, and family income. Caregivers' perceptions about the child's experiences with past hospitalizations and painful procedures were also requested

Part three: Assessment of the reinforcement and reinforce

that the child was exposed to Collect data about , the use of reinforcement by the mother, types of reinforcement, how can the mother use positive reinforcement and the favorite reinforce for the child

II-Pain Assessment tool: It was classified into two parts :

Part one: FLACC Scale - "Observer Rated Pain Scale"

points, that classify pain , score 0 means no pain, score from 1- 3 mild pain, 4-7 moderate pain and 8-10 severe pain. ^(10,22)

Part two: Wong Baker faces Pain Scale:

The Wong Baker Faces Pain Scale combines pictures and numbers to allow pain to be rate by the user. The faces range from a smiling face to a sad, crying face. A numerical rating is assigned to each face, of which there are 6 total faces: No hurt face takes zero, hurts little bit takes 2, hurts little more score 4, hurts even more takes 6, hurts whole lot score 8 and hurts worst takes10 ⁽²⁴⁾

III- The third tool:

was used to assess children' heart rate and oxygen saturation 15 minutes before vein puncture , during vein puncture 15 minutes after vein puncture

Methods:

Permission to carry out the study was obtained from the directors and the responsible specialists of the chosen setting after explaining the aim of the study. Care givers who accepted to participate in the study also involved after simple explanation of the aim of the study. The researcher emphasized to care givers that the study was voluntary and anonymous. Mothers had the full right to refuse to participate in the study at any time .Privacy and confidentiality was put into consideration regarding data collected. A pilot study was conducted on 8 children to ensure the applicability of the tools and the necessary modifications were done. The field work carried out within duration of 3 months. A baseline heart rate was obtained after each child had rested for 15 minutes in a sitting position. Heart rate and oxygen saturation was monitored with a pulse ox meter, before, during and 15 minutes after vein puncture. Children's behavioral responses were measured before and after reinforcement, using the Pain Assessment Tool "Observer Rated Pain Scale "FLACC scale", and Wong Baker Faces Pain Scale. After collecting demographic data, the type of reinforcer was chosen after observation and interview. The reinforcement is individualized according to children preference and motivation. It consistently delivered after a desired behavior. The reinforcer was administered immediately after a desired behavior, and

after simple explanation for the child. Data collection regarding pain was started after 4 consecutive use of positive reinforcement of a desired behavior in other procedures. Reinforcer was used to observe children' pain during vein puncture and to evaluate the effect of positive reinforcement on children FLACC , Wong -Baker faces, heart rate and oxygen saturation. The caregivers "mothers" were involved in all steps of data collection.

Statistical analysis:

The collected data were organized, tabulated and statistically analyzed using SPSS. For quantitative data, mean and standard deviation were calculated. For qualitative data the number, percent distribution was calculated. Chi square was used as a test of significance and when found inappropriate. Significant was adopted at $P \leq 0.05$ for interpretation of results of test of significant.

Results

Thirty percent of the children were $3 < 4$ years, Slightly more than one quarter (27%) and (18%) aged between $4 < 5$ and $5 < 6$ years respectively, while, one quarter of children aged between $6 \leq 7$ years Regarding to mothers' ages, it was clear that, more than one third (35%) of the mothers aged between $35 \leq 40$ years, (28%), (22%), and (15%) aged between $30 < 35$, $25 < 30$ and $20 < 25$ years respectively. (Fig. I&2).

As regards past hospitalization, nearly one third of the children (32.5%) and (27.5%) had history of previous hospitalization once, 2-3 times respectively. Compared to (10 %) of the children who didn't hospitalized before.

More than two thirds of the children (72.5%) were exposed to painful procedures,

while (27.5%) were not exposed to painful procedure during their hospitalization. Thirty seven point five percent of the children had vein punctured once, while (30%) and (27%) had vein puncture attempts from 2-3 or 3-5 times. (Table I)

Regarding to the mothers' use of positive reinforcement, it was clear that, all mothers (100%) used positive reinforcement with their children in their daily life. Slightly more than half of them (57%) used tangible reinforcers, (17%) and (15%) used natural or token economy reinforcers and only one tenth used social type of reinforcers. Equal percent of the mothers, (37.5%) apply reinforcement either before doing something or as token economy compared to (22.5%) of the mothers who gave reinforcement immediately after action. Fifty seven point five of the children prefer toys as reinforcers compared to, (32.5%) and (10%) of them who prefer something to eat or stickers respectively. (Table II).

Comparison of children according to FLACC pain scale before and after reinforcement showed high statistical significant differences regarding Face, activity, cry and consol ability, The mean of pain expressed by face was $2.13 + .86$ before reinforcement compared to $1.51+0.67$ after reinforcement. In relation to activity, the mean was $1.85 +0.78$ and $1.43+0.61$ before and after reinforcement respectively. Regarding cry the mean was $1.83 +.73$ before reinforcement and $1.39+0.54$ after reinforcement. The mean consol ability was $5.35+1.77$ before reinforcement and $2.73 +1.07$ after reinforcement. Wong baker

scale revealed that, (10%) and (63.8%) of the children expressed hurts little bit before and after reinforcement respectively, equal percent of (30%) were hurts little more, (42.5%) and (2.5%) were hurts even more before and after reinforcement respectively. None of the children expressed neither no hurts nor hurts worst before and after reinforcement. High statistical significant differences were found regarding Wong Baker Scale before and after reinforcement. (Table (III).

In relation to pulse and oxygen saturation, it was clear that, the mean pulse 15 minutes before vein puncture, was ($91.53 +12.62$) and ($88.6 +10.6$) before and after reinforcement, the mean pulse during vein puncture were ($106.45 + 13.3$) and ($95.7+ 5.3$) before and after reinforcement, compared to, ($99.6 + 12.33$) and ($92.14+ 8.4$) before and after reinforcement There were highly statistical significant differences before, during and after vein puncture before and after reinforcement. As regards, the mean of oxygen saturation was (96.5 ± 5.4) and (96.5 ± 3.4) 15 minutes before vein puncture before and after reinforcement respectively and no statistical significant difference was found. During vein puncture the mean was ($94.4 +4.7$) and (93.0 ± 2.28) before and after reinforcement respectively Statistical significant difference was found during and after vein puncture. (Table IV)

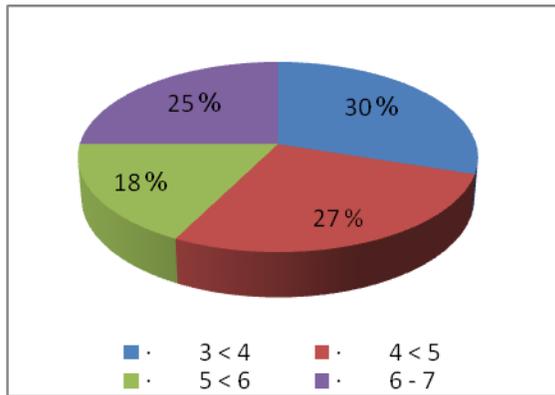


Figure (I)
Distribution of Children According to Age

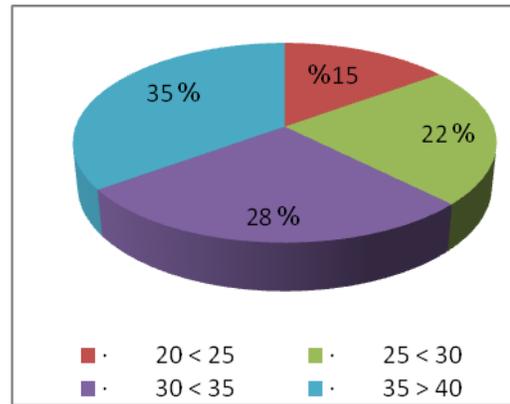


Figure (II)
Distribution of the Mothers According to Age

Table (I) Distribution of Children According to Medical History

Medical history	n = 80	Percent
Past hospitalization		
• No past hospitalization	8	10.0
• Once	26	32.5
• 2 –	22	27.5
• 4-	14	17.5
• 6- 7 times	10	12.5
Exposure to painful procedure		
• Yes	58	72.5
• No	22	27.5
No. of I.V. trails		
• Once	30	37.5
• 2 - 3 times	24	30.0
• 3 - 5 times	22	27.5
• > 5 times	4	5.0

Frequent distribution needs to be correct

Table (II) Distribution of the sample according to history of reinforcement

Reinforcement	n = 80	Percent
Mothers routinely use positive reinforcement	80	100
• Yes		
Type of reinforcers used by mothers		
• Tangible	46	57.5
• Natural	14	17.5
• Token economy	12	15.0
• Social	8	10.0
Time of reinforcement		
• Before doing something	30	37.5
• During action	2	2.5
• Immediate after action	18	22.5
• Token economy	30	37.5
Favorite reinforcers for children		
• Toys	46	57.5
• Something to eat	26	32.5
• Stickers	8	10.0

Table (III) Comparison Of Children According to FLACC and Wong Baker Pain Scale Before and After Reinforcement.

FLACC/ Wong Baker	Before reinforcement		After reinforcement		T- test	P
	Mean	SD	Mean	SD		
FLACC						
• Face	2.125	0.862	1.512	0.674	4.752	0.000*
• Legs	1.425	0.611	1.462	0.635	0.359	0.720
• Activity	1.850	0.781	1.425	0.611	3.994	0.000*
• Cry	1.825	0.725	1.387	0.539	4.661	0.000*
• Consolability	1.612	0.771	1.350	0.505	2.752	0.007*
Wong Baker	5.350	1.765	2.725	1.067	11.725	0.000*

* Significant " $P \leq 0.05$ "

Table (IV) Comparison of children according to Pulse and Oxygen saturation before and after reinforcement

Pulse and Oxygen saturation	Before reinforcement		After reinforcement		T-test	P
	mean	SD	mean	SD		
Pulse						
15 min. before vein puncture	91.53	12.62	88.6	10.6	1.5	0.133*
• During vein puncture	106.45	13.33	95.7	9.98	5.3	0.000*
• After vein puncture	99.6	12.3	92.14	8.4	4.2	0.000*
Oxygen saturation						
15 min. before vein puncture	96.5	5.4	96.5	3.4	0.05	0.95
• During vein puncture	94.4	4.7	93.00	2.28	1.8	0.005*
• After vein puncture	98.07	1.99	98.7	1.7	1.8	0.067

* Significant " $P \leq 0.05$ "

Discussion

Positive reinforcement involves praising children for being brave during a procedure. Rewards, like toys, games, stickers, or other trinkets were used. Positive reinforcement is considered one of the behavioral non-pharmacological interventions for pain reliever. It include teaching children to control their bodily sensations (feelings). The relative effectiveness of positive reinforcement and pain management, however, have not been previously evaluated. The child is rewarded with positive statements or concrete gifts, after the painful procedure (e.g., stickers, toys, games, small trophies) ⁽²⁵⁻²⁷⁾

The results of the present study indicated that children express less pain during vein puncture after using reinforcement than did before reinforcement. This may be due to the effective use of positive reinforcement as one of a non-pharmacological pain reliever.

This results is congruent with the study of Wendy B. et al. (2001), who stated that reinforcement in the form of praise , stickers, small toys is intended reward the child to provide an incentive for engaging in coping behavior , thus increase the likelihood that the child will perform the behaviors again in the future. ⁽²⁸⁻³¹⁾ Kuppenheimer and Brown (2002) likewise concurred that distress was reduced in various distraction studies about children with cancer. This may postulated that positive reinforcement motivate children to show courage when confronted with repeated painful events. ⁽³²⁾

Pain scores recorded as a baseline before reinforcement and after reinforcement showed statistically significantly differences this may be due to the use of positive reinforcement several times before the actual pain assessment after reinforcement.

Reinforcement of positive behavior was started and after 4 consecutive trials using reinforcement for desired behavior "repeated positive reinforcement" assessment of pain was performed. Simple explanation and the conditioning that result from the use of positive reinforcement after needed behavior is another justification. The selection of a type of reinforcer according to each child's individual preference also had a positive effect in the reinforcement of behavior.

The findings of the present study were supported by the study of Gray et al (2002) who mentioned that increase in cooperation and decrease in distress was observed in many children before and after vein puncture due to the use of both verbal and tangible positive reinforcement.⁽³³⁾

FLACC and Wong Baker Scale in the present study, showed statistical significant differences before and after reinforcement. These findings is congruent with the study of McClellan C.B. Et al (2009) who found that, child-report, parent-report, and observational measures all showed significant changes from pre- to post-vein puncture. This may be indicating sensitivity of the measures to procedural pain.⁽³⁴⁾

The mean of heart rates that were measured as abaseline, 15 minute before vein puncture during and after vein puncture showed high statistical significance before and after reinforcement. The statistical significance differences in our study may be due to the difference of inclusion criteria of the sample

between the present study and the other study, also the difference of the non-pharmacological method used in the two studies.

These findings is inconsistent with the study of McClellan C.B. Et al (2009) who were reported that no significant differences between baseline and pre-procedural heart rate and Heart rate did not show the expected increase from pre- to post-vein puncture, this study found significant pain at baseline in this pediatric sickle cell population. This study was also, ignored the contribution of pre-existing pain and actual procedural pain so, there were no statistical significance regarding heart rate in their study.⁽³⁴⁾

The results of the present study were also, incongruent with the study of Efe and Ozer (2007) and Dilli D. et al. (2009) who measured audio-recorded duration of crying beginning immediately after injection to cessation of crying up to the maximum time of 3 minutes, and oxygen saturation and heart rates during injection and after removal of the needle. The reported that, the total duration of crying was significantly shorter in the breastfeeding group and no significant difference between the 2 groups in heart rate or oxygen saturation.^(35,36) The researchers reported possible limitation in these studies which was the limitation of documentation if the infants were weighed pre and post breastfeeding. No indication for milk transfer occurred. Some of the

infants may have received little to no milk transfer during the 2 minutes prior to the heel-stick, thereby having a negative effect on the outcome.

Limitation

This study has several limitations. The small sample size and limited age range that limit generalization of the findings to other age groups. Active participation of the mothers in the present study, and education about positive reinforcement and the most appropriate type and time of reinforcement.

Conclusion

Based on the present study and research question, it concluded that:

High statistical significant differences were found regarding FLACC Scale -Pain Assessment Tool- "Observer Rated Pain Scale and Wong Baker Scale before and after reinforcement. In relation to pulse and oxygen saturation there was statistical significant difference during vein puncture. According to this study supports the view that the positive reinforcement as a behavioral non-pharmacological nursing interventions are to be beneficial to children who undergo vein puncture.

Recommendations

1. The present study should be replicated with a larger sample size in children undergoing other painful procedures.
2. Develop Educational program for nursing staff to increase the skills of positive reinforcement of well or healthy behaviors of children.

3. Training for nursing staff to encourage children and their parents to be self-assessing and self-reinforcing of well behaviors
4. Assess children's pain and identify the factors that may aggravate pain experience.
5. Further research is needed to help children cope with aversive medical procedures
6. Matching interventions with children's age, fears, and temperament

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