

Anxiety Levels among Five-Year-Old Children Undergoing ART Restoration- A Cross-Sectional Study

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ABSTRACT

Introduction: Atraumatic Restorative Treatment (ART) involves manually excavating the carious part of the tooth and restoring the prepared cavity with chemically adhesive restorative material [Glass Ionomer Cement (GIC)] and it may induce and/or impact the dental anxiety in children. It is well established that ART procedure is less anxiety producing when compared with other restorative procedures using dental drill.

Aim: The aim of this study was to evaluate the anxiety levels among five-year-old children undergoing ART restoration in I.T.S. Dental College, Greater Noida, India.

Materials and Methods: A sample of 50, five-year-old children visiting the Outpatient Department (OPD) of ITS Dental College, Greater Noida was selected for ART treatment using Fuji IX GIC. Modified Venham Anxiety Scale based on their behaviour and heart rate of the children were measured and recorded before,

during and after the ART procedure. Heart rate was measured using Radial Pulse examination method. Chi-square test was used and tests were conducted using IBM SPSS software (ver.20.0; IBM, Chicago, IL, USA).

Results: Before the ART treatment, heart rates and Modified Venham Anxiety Scores of majority of children were higher than that after the treatment. A p-value was statistically significant (0.028 and 0.048 respectively) for association of gender with heart rate and Modified Venham's score before the ART treatment. No statistically significant relation was found between the variables during and after the ART treatment.

Conclusion: The level of anxiety for ART treatment in children was higher before the treatment than that during and after the treatment. There is a correlation between the gender of children and their level of anxiety for ART treatment.

Keywords: Atraumatic restorative treatment, GIC, Heart rate, Modified Venham scale of anxiety

INTRODUCTION

Atraumatic Restorative Treatment (ART) is practiced as a minimally invasive technique to excavate dental caries using hand instruments and restore the tooth routinely with GIC. The key advantages of using GIC for restoring such carious teeth are that they are fluoride releasing, biocompatible with tooth pulp and chemically bond to the tooth [1]. Originally ART was intended for economically underdeveloped populations with limited resources [1,2]. It is a pain-free restorative procedure that does not require electricity [2], is readily accepted by children [1], has vast indications in industrial countries especially for very young children newly introduced to oral health care [3], patients who are extremely fearful or anxious about dental procedures [4,5], mentally or physically compromised patients [5], elderly and nursing home resident patients [6], and patients with high risk caries status [3,7]. ART has previously been proven to be a cost-effective treatment modality for restoration of carious lesions in elderly [8]. Moreover hand instrumentation used in ART, although more time consuming, has proven to be more tooth preserving technique of excavating caries and GIC used in it has delayed setting reaction providing adequate working time to the operator [9]. Fear and anxiety exist as inherent qualities in humans and their absence and excess represent a shadow of pathology [3]. Although ART is a simple restorative procedure, it may influence and trigger the anxiety in children for dental procedure. In case of children, anxiety for dental treatments may be acquired from mother who previously underwent dental treatments too [4]. Because of the marked improvements in ART technique and adhesive restorative materials as well, ART is routinely practiced in dental hospitals and clinic setups also. It is well established that ART procedure is less anxiety producing when compared with other restorative procedures

using dental drill. A very few studies have directly compared the anxiety in children for ART restorations in situations where it is performed in hospital dental setup [10]. Thus, the aim of this study was to evaluate, assess and compare the levels of anxiety in five-year-old children undergoing ART restorations in a dental college in Greater Noida, Uttar Pradesh, India.

MATERIALS AND METHODS

This cross-sectional study was done on a sample of 50, five-year-old children selected by convenience sampling, visiting the OPD of ITS Dental College, Greater Noida in a period of two months (September and October, 2015). Ethical clearance was obtained from the Ethical Committee of the College. Informed consent was taken from the parents/guardians of the children selected for this study. Five-year-old children with carious lesions involving dentin and accessible to hand instruments were selected for the study.

Exclusion criteria were; children aged other than five-year-old age; carious lesions extending to or approaching the pulp; presence of sinus, fistula or swelling near the carious tooth; tenderness on percussion in tooth; carious lesion inaccessible to hand instrumentation. The extent of caries, absence or presence of tenderness, periodontal and endodontic status of teeth was determined by signs, symptoms and careful clinical oral examinations of patients. The treatments followed standard ART procedure using hand instruments and a portable light [10]. The restoration material used was Fuji IX Glass Ionomer Cement (GC Fuji IX, Tokyo, Japan), a hand-mixed glass ionomer recommended for use in Class I primary teeth restoration. The press-finger technique for condensing the restorative material into the prepared cavity was employed to facilitate a sealant restoration. This technique was performed with a gloved finger lubricated with light amount of petroleum jelly. No local

Score	Criteria
0	Relaxed: Smiling, willing, able to converse, displays behaviour desired by the dentist
1	Uneasy: Concerned, may protest briefly to indicate discomfort, hands remain down or partially raised. Tense facial expression, 'high chest'. Capable to cooperating.
2	Tense: Tone of voice, question and answers reflect anxiety. During stressful procedure, verbal protest, crying, hands tense and raised, but not interfering very much. Protest more distracting and troublesome. Child still complies with request to cooperate.
3	Reluctant: Pronounced verbal protest, crying. Using hands to try to stop procedure. Treatment proceeds with difficulty.
4	Interference: General crying, body movements sometimes needing physical restraint. Protest disrupts procedure.
5	Out of contact: Hard loud crying, swearing, screaming. Unable to listen, trying to escape. Physical restraint required.

[Table/Fig-1]: Venham Index (modified 6-point scale according to Venham) [11].

anaesthesia was used for any of the restorations.

Modified Venham Anxiety Scale [Table/Fig-1] [11] and heart rate [Table/Fig-2] [12] of the children were measured at three points during the ART procedure:

- (I) when the child entered the treatment room;
- (II) during the treatment;
- (III) after the treatment.

At each of these time intervals, the heart rate of the patients was measured using radial pulse examination. General behaviour of the child during the whole treatment was also registered, again on the Modified Venham Anxiety Scale.

Normal heart rate in three to six year-old aged children is 65 to 110 heart beats/min. Heart rates of the most of the subjects in this study came to be falling in normal range of 65 to 110 beats/min approximately. Since this range is wide, most of the heart rate readings in this study fell in normal only and to find out the relation between the increase and decrease in heart rates of children and anxiety levels before, during and after the ART restorative treatment, we chose to consider the classification of heart rate as low, normal, high, very high.

STATISTICAL ANALYSIS

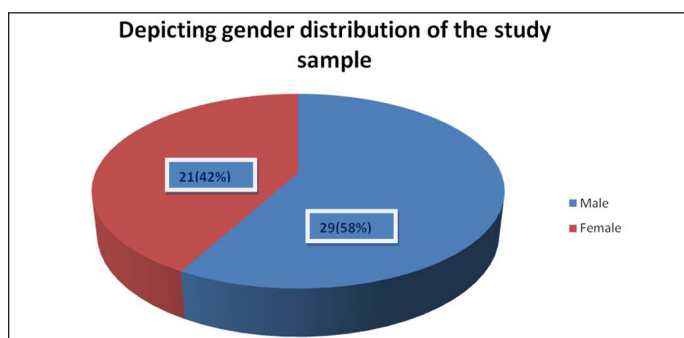
Statistical software was used for data entry (Microsoft Office Excel 2010 for Windows, Microsoft Corporation, Redmond, WA, USA) and all statistical tests were conducted using IBM SPSS software (version 20.0; IBM, Chicago, IL, USA) and $p < 0.05$ was considered for statistical significance. Chi square test ($p < 0.05$) was used to find associations between gender and heart rate; and gender and Modified Venham score of anxiety before, during and after the ART treatment in subjects.

RESULTS

Among the 50 children participating in the study 29 (58%) were boys and 21 (42%) were girls [Table/Fig-3]. Out of 50 children examined, only 3 (6%) children had 'very high' heart rate before and during the ART treatment whereas 23(46%) children had 'high' heart rate and 24 (48%) children had 'normal' heart rate. However, only one child (2%) had 'very high' heart rate post treatment, 17 children (34%) had 'high' heart rate and 32 children (64%) depicted 'normal' heart rate [Table/Fig-4]. Most of the children (36%) were scored 3 (tense) post-treatment on Modified Venham Anxiety Scale whereas, 44% of children were scored 1 (Uneasy) during the treatment. There was increase in children with score 0 (Relax) after the treatment from 12% children before and 10% children during the treatment to 26% children post treatment. 68% children were scored 0 (Relax) and 1 (uneasy) after the ART treatment whereas, only 4% of them scored 4 (interference) and 5 (out of control). [Table/Fig-5]. Statistically significant association ($p=0.028$) was found between gender and

Heart Rate (Beats/Minute)	Criteria
<60	Low
60-80	Normal
81-100	High
>100	Very High

[Table/Fig-2]: Classification criteria of heart rate used in study [12].



[Table/Fig-3]: Gender distribution of the study sample.

Heart Rate	Pre Treatment	During Treatment	Post-treatment
Normal	24 (48%)	24 (48%)	32 (64%)
High	23 (46%)	23 (46%)	17 (34%)
Very High	3 (6%)	3 (6%)	1 (2%)

[Table/Fig-4]: Heart rate before, during and after ART treatment.

MVS Score	Pre Treatment	During Treatment	Post-Treatment
0(Relax)	6 (12%)	5 (10%)	13 (26%)
1(Uneasy)	8 (16%)	22 (44%)	21 (42%)
2(Tense)	18 (36%)	11 (22%)	6 (12%)
3(Reluctant)	8 (16%)	2 (4%)	8 (16%)
4(Interference)	4 (8%)	6 (12%)	1 (2%)
5(Out of contact)	6 (12%)	4 (8%)	1 (2%)

[Table/Fig-5]: Modified Venham Scale (MVS) score before, during and after ART treatment.

	Heart Rate (Male)	Heart Rate (Female)	p-value
Before Treatment			
Normal	12 (41.4%)	12 (57.1%)	0.028*
High	17 (58.6%)	6 (28.5%)	
Very high	0	3 (14.4%)	
During Treatment			
Normal	13 (44.8%)	11 (52.3%)	0.062
High	16 (55.2%)	7 (33.3%)	
Very high	0	3 (14.4%)	
After Treatment			
Normal	21 (72.4%)	11(52.3%)	0.225
High	8 (27.6%)	9 (42.8%)	
Very high	0	1 (4.9%)	

[Table/Fig-6]: Association between gender and heart rate*.

* p-value less than 0.05 is considered to be significant

Chi-square test applied

heart rates of children before the ART treatment. Normal heart rates were examined in 41.4% boys and 57.1% girls before the treatment whereas 58.6% boys and 28.5% girls had high heart rate. Very high heart rate was only evident in girls (14.4%) before the treatment [Table/Fig-6]. Statistically significant association ($p=0.048$) was found between gender and Modified Venhem Anxiety scores of children before the ART treatment. A total of 58.4% boys and 71.4% girls were scored ≤ 3 on Modified Venham anxiety scales whereas 41.3% boys and 28.6% girls were scored ≥ 4 before the treatment

	MVS (Male)	MVS (Female)	p-value
Before Treatment			
Relaxed 0	2 (6.8%)	4 (19%)	0.048*
Uneasy 1	3 (10.3%)	5 (23.8%)	
Tensed 2	12 (41.3%)	6 (28.6%)	
Reluctant 3	8 (27.6%)	0	
Interference 4	1 (3.4%)	3 (14.3%)	
Out of contact 5	3 (10.3%)	3 (14.3%)	
During Treatment			
Relaxed 0	3 (10.3%)	2 (9.5%)	0.257
Uneasy 1	11 (37.9%)	11 (62.4%)	
Tensed 2	9 (31%)	2 (9.5%)	
Reluctant 3	2 (6.8%)	0	
Interference 4	3 (10.3%)	3 (14.3%)	
Out of contact 5	1 (3.4%)	3 (14.3%)	
After Treatment			
Relaxed 0	5 (16.5%)	8 (38%)	0.075
Uneasy 1	14 (49.7%)	7 (34.6%)	
Tensed 2	6 (20.6%)	0	
Reluctant 3	4 (13.2%)	4 (19%)	
Interference 4	0	1 (4.2%)	
Out of contact 5	0	1 (4.2%)	

[Table/Fig-7]: Association between gender and Modified Venham score[#].

*p-value less than 0.05 is considered to be significant

Chi-square test applied

[Table/Fig-7]. In this study heart rate was measured using radial pulse examination, which by itself will be less anxiety provoking in children and also positive correlation was established between heart rate and Venham score at all three moments of measurements. Most of the children irrespective of gender accepted the ART treatment except 6% children who were fearful and very anxious before and during the treatment, however this was curtailed to 2% after the treatment. Majority of patients were tensed (Venham score 2) before ART, probably because of their first experience of a dental procedure however 44% and 42% children were uneasy during and after the treatment respectively. Before the ART treatment, heart rates and Modified Venham Anxiety scores of majority of children were higher than that after the treatment. A p-value was statistically significant (0.028 and 0.048 respectively) for association of gender with heart rate and Modified Venham's Anxiety score before the ART treatment. No statistically significant relation was found between the variables during and after the ART treatment.

DISCUSSION

ART technique is most commonly practised using GIC as restorative material of choice. GIC benefits the tooth as a restoration because of its chemical bonding with tooth, coefficient of thermal expansion is close to that of dental tissue [13], it is biocompatible restoration [14], causes anti caries effect [15,16], possesses antibacterial properties [17] and induces remineralization which prevents secondary caries development [18]. GIC also serves as a rechargeable fluoride release system [18,19]. The ART technique has already been proved as a successful restorative procedure since many years in several countries on children giving the varied success rate for retention from 63% to 100% [20-24]. ART procedure has been performed by few researchers in clinical dental setup on children [7]. ART has been compared with other procedures (using dental drill) and found to be well accepted and less anxiety producing [4,25]. The objective of this study was to evaluate the anxiety levels in children for ART restorations before, during and after the treatment. Dental anxiety has been related with many factors like individual's internal factors, environment in which he/she lives and the situation of

dental treatment [26,27]. Previous researches have reported the environmental influence on the coping pattern of children undergoing dental treatment [26]. Hospital dental setup, hospital environment, hospital staff and other hospital armamentarium can by itself make children anxious and influence their behaviour. Researchers have investigated fear and anxiety in children using different scales and measurements [28-31]. Modified 6-point Venham Index was used in this study whose validity and reliability has been substantiated by previous researchers [32] and for comparative purposes, the clinical criteria (heart rate and Modified Venham Index scores) used to evaluate the anxiety of children for ART restorations in this study were similar to those used in previous ART study by Schriks MC, van Amerongen WE [4]. Heart rate measurement as related to dental anxiety has been researched and found to be positively related to each other [4]. This study was in accordance with the previous study by Roshan NM and Sakeenabi B [32] as the ART treatment was well accepted by most of the children and there was significant reduction in the level of anxiety as the ART treatment progressed from starting to end. Astoundingly more number of male patients were anxious than female patients before the treatment however maximum anxiety level was found in girl patient with Venham score 5 (Out of contact) and very high heart rate before, during and after ART treatment. This observation was in contrast with the conclusion by Schriks MC and van Amerongen WE that there is more anxiety for dental procedure in girls than in boys [4].

The high acceptance of ART restorative treatment amongst children and adults has been earlier verified by Mickenautsch S and Rudolph MJ [33]. As per Mickenautsch S et al., the possible reason for this could be absence of local anaesthetic applications and noisy dental drills [34]. Lo ECM and Holmgren CJ did the study on ART approach whereby they placed 170 ART restorations in 95 children aged 5.1±0.7 years and reported that 86% of those children were willing to get the ART treatment again suggestive of high acceptability rates of ART amongst children [35]. Mickenautsch S and Rudolph MJ reported that the expressions of the patients undergoing ART treatment changes from fearful to more relaxed as the treatment progresses [36]. de Menezes Abreu DM et al., stated in their study that ART is the best treatment option in younger children [37]. However Xia B et al., concluded in their study that behaviour management problems of a child in dental setup are more at their younger age; the younger the child more behavioural problems are expected and thus behaviour management expertise is required to operate younger children for ART treatment [38]. High acceptability rate for ART restorative dental procedure amongst younger children as per this study along with previous studies [32,33,35], adequate survival rates of ART restorations [39,40] and cost effectiveness of ART as compared with amalgam and composite resin restorations as per study by Mickenautsch S et al., favours the implementation of ART approach in clinical settings and community based oral health care programs as well [41]. ART has already been suggested as effective treatment modality to manage and curtail the burden of large prevalence of early childhood caries [42].

This study had not however encompassed all the possible factors attributed to the dental anxiety in children for ART restorative treatment and thus further studies are strongly recommended on the same because of the lack of literature on development and influencing factors of dental anxiety in children for ART treatment. This study did not include the assessment of level of dental anxiety in multiple visits of patients, however past dental visits play a prominent factor in influencing the anxiety level for any dental procedure. Thus, longitudinal studies are required to identify, evaluate and eliminate dental anxiety producing factors present before the ART treatment in the young children. There is also a need to raise awareness regarding dental caries and its different treatment caries modalities especially ART amongst all the stakeholders.

CONCLUSION

In the given study population ART approach was well accepted in children of five years age. Initial anxiety for ART treatment was more and as the treatment was progressing, the level of anxiety was dropping down. Astounding difference could be observed in pre treatment anxiety levels on the basis of gender, whereby boys had higher anxiety as compared with that of girls.

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