

Anxiety in Children during Occlusal ART Restorations in Primary Molars Placed in School Environment and Hospital Dental Setup

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Objective: To evaluate the anxiety in children during occlusal atraumatic restorative treatment (ART) in the primary molars of children; and compare the anxiety for ART procedure performed in school environment and in hospital dental setup. **Study design:** A randomized controlled trial where One dentist placed 120 ART restorations in 60 five- to seven year-olds who had bilateral matched pairs of occlusal carious primary molars. A split-mouth design was used to place restorations in school and in hospital dental setup, which were assigned randomly to contralateral sides. Anxiety was evaluated by Modified Venham score and the heart rate of the children at five fixed moments during dental treatment. **Results:** At the entrance of the children into the treatment room, statistically significant difference between treatment in school environment and treatment in hospital dental setup for venham score and heart rate could be found ($P=0.023$ and $P=0.037$ respectively). At the start of the treatment procedure higher venham score and heart rate was observed in children treated in hospital dental setup in comparison with the children treated in school environment, finding was statistically significant ($P=0.011$ and $P=0.029$ respectively). During all other three points of treatment, the Venham scores of the children treated in school were lower than those of the children treated in hospital dental setup but statistically not significant ($P>0.05$). Positive co-relation between Venham scores and Heart rate was established. No statistically significant relation could be established between boys and girls. **Conclusions:** Overall anxiety in children for ART treatment was found to be less and the procedure was well accepted irrespective of environment where treatment was performed. Hospital dental setup by itself made children anxious during entrance and starting of the treatment when compared to children treated in school environment.

Keywords: Atraumatic restorative treatment, Dental Caries, Primary Molars, Anxiety
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INTRODUCTION

Atraumatic restorative treatment (ART) is a minimally invasive technique for removing soft, demineralized, carious dental tissue using hand instruments, followed by restoration of the tooth with an adhesive restorative material—routinely glass ionomer cement (GIC).¹ ART was originally developed for and introduced to economically underdeveloped populations with limited resources.^{1,2} It also has applications in industrial countries,

however, especially for very young children who are being introduced to oral care,³ patients who experience extreme fear or anxiety about dental procedures,^{4,5} mentally and/or physically handicapped patients,⁵ home-bound elderly and nursing home resident patients,⁶ and patients from high-risk caries clinics who can benefit from ART as an intermediate treatment to stabilize conditions.^{3,7}

Although ART uses only manual excavation and restoration of cavity with chemically adhesive restorative material, the environment in which it is performed may influence the anxiety in children for dental procedure. The ART procedure is established for field and detailed procedural instructions have been laid in manual for ART by WHO. With the increase in knowledge of caries process and improvement in adhesive dental restorative materials the procedure of ART is implemented as minimal invasive technique in hospital dental setup also.⁸ ART procedure is established to be less anxiety producing when compared with procedures using dental drill. No previous study has directly compared the anxiety in children for ART restorations in situations where

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it is performed in school environment and in hospital dental setup.

The objectives of this clinical study were to:

1. Evaluate, the anxiety in children for occlusal Class I ART restorations placed in primary molars.
2. Compare the anxiety in children for class I ART restorations performed in school environment and in hospital dental setup.

MATERIAL AND METHODS

Sixty primary school children who had a matched pair of primary molars with an occlusal carious lesion of a similar size extending into the dentine with an entrance large enough to allow access by hand instruments—were selected for ART treatment. Teeth were excluded if there was a definite or likely pulpal exposure or an associated abscess. Prior to treatment, written consent was obtained from all parents/guardians through the school authorities.

One hundred-twenty restorations were placed in 60 children by the same dentist with the help of one dental hygienist using the ART technique. A split-mouth design was used to place the ART restorations in school environment and hospital dental setup, assigned randomly to contralateral sides. The treatment was performed in the schools following the standard ART procedure using hand instruments and a portable light. Same children were treated for another ART restoration in department of pedodontics clinic on dental chair. 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. Each child received 2 ART restorations: one performed in school environment; and one performed in pedodontic clinic dental setup.

The press-finger technique was used to condense the material into the cavity and adjacent pits and fissures, thus providing a sealant restoration by using a gloved finger lightly lubricated with petroleum jelly. After the restorations were set initially and the dentist performed an occlusal adjustment, cavity varnish was applied over them. No local anesthesia was used for any of the restorations.

Modified venham anxiety scale (Table 1) and heart rate of the children were measured at five points during the ART procedure: (I) When the child entered the treatment room, (II) at the start of excavation, (III) at the moment of deepest excavation, (IV) at the moment the restoration was applied, and (V) after completion of treatment. At each of these time intervals, the heart rate of the patients was measured using a portable pulse oximeter device applied on the finger of the child. General behavior of the child during the whole treatment was also registered, again on the modified venham scale (Venham overall score). Finally, the highest observed score was noted as the Venham peak score. Both the recordings of the heart rate and the observations were carried out by one of the authors, not taking part in actual treatment of the children.

To analyse a difference in the venham score between both

Table 1. Venham Index (modified 6-point scale according to venhem)

Score	Criteria
0	Relaxed: smiling, willing, able to converse, displays behavior 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 requires

treatment groups, a chi-square test for trend was used. Student's t-test was used to analyze the heart rates of the children recorded in both the treatment groups. The relation between the heart rate and the Venham score was estimated by Pearson's correlation coefficient. For all the tests, significance level of 0.05 was used. Duplicate examinations were conducted on a random 15% sample of children to assess the intra examiner reproducibility for recording of venhem behavioral scale; the overall Cohen's kappa value in both assessments was 0.83. The data were analyzed using a software program SPSS 17.0 for Windows.

RESULTS

The mean age of children at the baseline was 6.23 years. Among 60 children 32 were girls and 28 were boys. The results of venham observations and the heart rate measurements are summarized in Table 2. At the entrance of the children into the treatment room, significant difference between treatment in school environment and treatment in hospital dental setup for venham score and heart rate could be found ($P=0.023$ and $P=0.037$ respectively)

At the start of the treatment procedure higher venham score and heart rate was observed in children treated in hospital dental setup in comparison with the children treated in school environment, finding was statistically significant ($P=0.011$ and $P=0.029$ respectively). During all other three points of treatment, the Venham scores of the children treated in school were lower than those of the children treated in hospital dental setup but statistically not significant ($P>0.05$). Positive co-relation between Venham scores and Heart rate was established.

Student's t-test on heart rate measurements of the children during the treatment shows no significant differences

Table 2. Statistical results of Venham scale, heart rate and correlation of both at different time points during treatment.

	Venham score Chi-square test for trends (P-value)	Heart rate Student's t-test (P-value)	Pearson Correlation (r)
Entrance	0.023	0.037	0.396
Start	0.011	0.029	0.324
Deep excavation	0.061	0.057	0.408
Restoration	0.058	0.073	0.433
End	0.090	0.082	0.694
Peak	0.073		
Overall	0.061		
P < 0.05= Statistically Significant			

between school environment and hospital dental setup except for the point of entrance and starting treatment where heart rate was significantly more for treatment in hospital dental setup ($P=0.037$ and $P=0.029$ respectively). No statistically significant relation could be established between boys and girls.

Initial venham score (during entrance into treatment room) showed a strong influence on the outcome measurement: the more anxious the children, the more their heart rate and venham score during treatment.

DISCUSSION

GIC is always the material of choice in the ART technique. This is because of its chemical adherence to dental tissue, coefficient of thermal expansion similar to that of a tooth [9], biocompatibility properties,¹⁰ and caries protective effect through the release of fluoride,^{10,11} which has antibacterial properties^{3,12} and potentiates remineralization that may prevent the development of secondary caries.¹³ Furthermore, GIC restorations may act as a rechargeable fluoride release system.^{14,15}

The ART approach has been field-tested for a number of years in various countries on children's giving the varied success rate for retention from 63% to 100%.¹⁶⁻²² 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.^{4,21} But, there are no studies to directly compare the anxiety of the children depending on the environment of treatment. Anxiety towards dental treatment has been associated to multifactor etiology, influenced by internal individual aspects, living environment and the dental treatment situation.^{23,24} The influence of environmental factors on coping style of the children has been reported by previous researchers.²² Hospital dental setup, hospital environment, hospital staff and other hospital armamentarium can by itself make children anxious and influence

the behavior of children. The objective of this study was to evaluate the anxiety in children for occlusal class I ART restorations placed in primary molars and to compare the anxiety in children for ART restorations performed in school environment and in hospital dental setup.

Researchers have investigated fear and anxiety in children using different scales and measurements.²⁵⁻²⁸ Modified 6-point Venham Index was used in this study whose validity and reliability has been substantiated by previous researchers^{29,30} and for comparative purposes, the clinical criteria used to evaluate the anxiety of children for ART restorations in this study were similar to those used in previous ART study by Schriks MCM, 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 In this study heart rate was measured with portable finger pulse oximeter, which by itself will be less anxiety provoking in children. In the present study also positive correlation was established between heart rate and venham score at all moments five moments of measurements. Statistically significant difference in heart rate was observed during entrance of the child into the treatment room and at the moment of starting of treatment in children receiving treatment in school and in hospital dental setup suggesting that, in school environment children were more relaxed. This finding suggests that anxiety in children may not be only because of dental procedure but also influenced by environment.

At the moment of deep excavation of caries Venham score and heart rate was increased in all the children irrespective of the environment of treatment which was statistically not significant ($P=0.61$ and $P=0.57$ respectively).

Gender is one of the confounding factors which may influence the anxiety levels in children. Gender difference according to fear and anxiety have been reported in several studies.^{31,32} In the present study, for the children of age group five to seven year anxiety levels as measured by venhem scale and heart rate did not show statistically significant difference. This result suggests that, for the given age group in this study anxiety level was similar in both boys and girls. This finding is in contrast to the observation by Schriks MCM and van Amerongen WE,⁴ who have reported more anxiety for dental procedure in girls than in boys.

According to the results of this study, overall the ART approach was well accepted and less stressful irrespective of environment of treatment. Physiological measurements (heart rate) did give a less definitive influence on treatment environment: only during entrance and starting point of treatment the children in hospital dental setup had significantly higher heart rate compared to treatment in school. Environment of treatment for children definitely influence the anxiety levels and behavior. Although ART approach is well accepted in children when compared to other minimal intervention procedures, anxiety in children should be approached by considering the influence of the environment. Hospital dental setup and dental staff should create an environment that is more relaxing especially to the children so as

to minimize the anxiety and expect maximum cooperation from children.

CONCLUSIONS

Based on this study's results, the following conclusions can be made:

1. In the given study population ART approach is well accepted in children of five to seven year age.
2. Initial anxiety for dental treatment is more in hospital dental setup compared to school environment
3. No difference in anxiety level is seen in five to seven year age group children according to gender.

REFERENCES

1. Smales RJ, Yip HK. The atraumatic restorative treatment (ART) approach for primary teeth: review of literature. *Pediatr Dent*, 22: 294–8, 2000.
2. Frencken JE, Pilot T, Songpaisan Y, Phantumvanit P. Atraumatic restorative treatment (ART): rationale, technique, and development. *J Public Health Dent*, 56: 135–40, 1996.
3. Carvalho TS, Ribeiro TR, Bönecker M, Pinheiro ECM, Colares V. The atraumatic restorative treatment approach: An “atraumatic” alternative. *Med Oral Patol Oral Cir Bucal*, 14: 668–73, 2009.
4. Schriks MC, van Amerongen WE. Atraumatic perspectives of ART: psychological and physiological aspects of treatment with and without rotary instruments. *Community Dent Oral Epidemiol*, 31: 15–20, 2003.
5. Mjör IA, Gordan VV. A review of atraumatic restorative treatment (ART). *Int Dent J*, 49: 127–31, 1999.
6. Honkala S, Honkala E. Atraumatic dental treatment among Finnish elderly persons. *J Oral Rehabil*, 29: 435–40, 2002.
7. Honkala E, Behbehani J, Ibricevic H, Kerosuo E, Al-Jame G. The atraumatic restorative treatment (ART) approach to restoring primary teeth in a standard dental clinic. *Int J Paediatr Dent*, 13: 172–9, 2003.
8. Tyas MJ, Anusavice KJ, Frencken JE, Mount GJ. Minimal intervention dentistry – a review. *FDI Commission Project 1-97 Int Dent J*, 50: 1–12, 2000.
9. Croll TP, Nicholson JW. Glass ionomer cements in pediatric dentistry: review of the literature. *Pediatr Dent*, 24: 423–9, 2002.
10. Hume WR, Mount GJ. In vitro studies on the potential for pulpal cytotoxicity of glass ionomer cements. *J Dent Res*, 67: 915–8, 1988.
11. Forsten L. Fluoride release and uptake by glass ionomers and related materials and its clinical effect. *Biomaterials*, 19: 503–8, 1998.
12. Duque C, Negrini Tde C, Hebling J, Spolidorio DM. Inhibitory activity of glass ionomer cements on cariogenic bacteria. *Oper Dent*, 30: 636–40, 2005.
13. Smales RJ, Gao W. *In vitro* caries inhibition at the enamel margins of glass ionomer restoratives developed for the ART approach. *J Dent*, 28: 249–56, 2000.
14. Donly KJ, Nelson JJ. Fluoride release of restorative materials exposed to a fluoridated dentifrice. *J Dent Child*, 64: 249–50, 1997.
15. Marinelli CB, Donly KJ, Wefel JS, Jakobsen JR, Denehy GE. An *in vitro* comparison of three fluoride regimens on enamel remineralization. *Caries Res*, 31: 418–22, 1997.
16. Frencken JE, Taifour D, van't Hof MA. Survival of ART and amalgam restorations in permanent teeth of children after 6.3 years. *J Dent Res*, 85: 622–6, 2006.
17. Frencken JE, van't Hof MA, Taifour D, Al-Zaher I. Effectiveness of ART and traditional amalgam approach in restoring single-surface cavities in posterior teeth of permanent dentitions in school children after 6.3 years. *Community Dent Oral Epidemiol*, 35: 207–14, 2007.
18. Phantumvanit P, Songpaisan Y, Pilot T, Frencken JE. Atraumatic restorative treatment (ART): A three-year community field trial in Thailand survival of one-surface restorations in the permanent dentition. *J Public Health Dent*, 56: 141–5, 1996.
19. Frencken JE, Makoni F, Sithole WD, Hackenitz E. Three-year survival of one-surface ART restorations and glass-ionomer sealants in a school oral health programme in Zimbabwe. *Caries Res*, 32: 119–26, 1998.
20. Frencken JE, Makoni F, Sithole WD. ART restorations and glass ionomer sealants in Zimbabwe: survival after 3 years. *Community Dent Oral Epidemiol*, 26: 372–81, 1998.
21. Rahimtoola S, van Amerongen E, Maher R, Groen H. Pain related to different ways of minimal intervention in the treatment of small caries lesions. *ASDC J Dent Child*, 67: 123–7, 2000.
22. Blount LB, Davis N, Powers SW, Roberts MC. The influence of environmental factors and coping style on children's coping and distress. *Clin Psychol Rev*, 11: 93–116, 1991.
23. Eli I, Uziel N, Bath R, Kleinhauz M. Antecedents of dental anxiety: learned responses *versus* personality traits. *Community Dent Oral Epidemiol*, 25: 233–7, 1997.
24. Freeman RE. Dental anxiety: a multifactorial aetiology. *Br Dent J*, 159: 406–8, 1985.
25. Aartman I, van Everdingen T, Hoogstraten J, Schuur A. Self report measurements of dental anxiety and fear in children: a critical assessment. *J Dent Child*, 252–8, 1998.
26. Amerongen WE, Rahimtoola S. Is ART really atraumatic? *Community Dent Oral Epidemiol*, 27: 431–5, 1999.
27. Berge M, Hoogstraten J, Veerkamo JSJ, Prins P. The dental subscale of the children's fear survey schedule: a factor analytic study in the Netherlands. *Community Dent Oral Epidemiol*, 26: 340–3, 1998.
28. Gatchel RJ. Managing anxiety and pain during dental treatment. *J Am Dent Assoc*, 123: 37–41, 1992.
29. Veerkamp JSJ, Gruythuysen RJM, van Amerongen WE, Hoogstraten J. Dental treatment of fearful children using nitrous oxide. Part 3. Anxiety during sequential visits. *J Dent Child*, 60: 175–82, 1999.
30. Nathan JE, Venham LL, Steward West M, Werboff J. The effect of nitrous oxide on anxious young pediatric patients across sequential visits: a double blind study. *J Dent Child*, 55: 20–30, 1998.
31. de Horst G, de Wit CA. Review of behavioural research in dentistry 1987-92: dental anxiety, dentist-patient relationship, compliance and dental attendance. *Int Dent J*, 43: 265–78, 1993.
32. Liddell A, Locker D. Gender and age difference in attitudes to dental pain and dental control. *Community Dent Oral Epidemiol*, 25: 314–8, 1997.