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Effectiveness of Chemomechanical Caries Removal Method in Comparison with Conventional Drilling Method on Behaviour and Acceptability Among Children 4-9 Years Old: Randomised Control Trial

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Abstract

Background: Chemomechanical method of removing caries is a type of minimal invasive technique that aims to preserve healthy tooth structure. It also helps to reduce dental fear among children.

Aim: The aim of this study was to assess and compare behaviour during caries excavation and patient acceptability of caries excavation by Chemomechanical caries removal method (CMCR) Gel and conventional drilling method on deciduous first molars in children aged 4-9 years.

Methodology: After receiving ethical approval, 24 children 4-9 years old with 48 carious primaryfirst molars were divided randomly into two groups. Group A: CMCR method and Group B: Conventional drilling method. Patient behaviour was assessed with Venham Behaviour Rating Scale and patient acceptance with Wong baker face pain scale. Patient behaviour and patient acceptance was assessed and compared between

the two methods. Data was collected, tabulated and statistically analysed.

Results: There was no significant difference observed in patient behaviour. But there was significant difference in patient acceptance among the two groups with CMCR method being better accepted.

Conclusion: The findings of our study indicates that CMCR method of caries removal can be considered as an alternative to conventional drilling method, especially in younger children, to diminish the fear and provide comfortable dental treatment to them.

Keywords: Dental caries, Chemomechanical caries removal (CMCR); Conventional Drilling; minimal invasive, Venham Behaviour rating scale, Wong baker face pain scale (WBFPS).

Introduction

Dental caries lesionwas described by Takao Fusayama in 1980 as lesion consisting of two layers: outer, acidic, irreversibly demineralized, touch sensitive layer that contains high levels of bacteria and is soft and inner, a partially demineralized, less contaminated layer that contains collagen fibrils in the dentinal tubules.(1)The earlier principle, since GV Black, was 'extension for prevention' in the treatment of dental caries. According to this principle, the sound structure and anatomical form of tooth, that may lead to plaque stagnation was removed to minimise dental caries progression. This was based on the clinical picture of caries and restricted to the restorative materials available then. (2,3)The conventional drilling is the most often used technique in removal of caries. But, this invasive procedure has many drawbacks, such as unpleasant perception, detrimental thermal and pressure effects on pulp, loss of healthy tooth structure and occasionally, local anesthesia may be required. (2,4)In recent times, advancements in adhesive restorative materials and the evolution of minimal cavity design have created challenges to the acceptance of this long standing principle. The use of air abrasion, sono-abrasion, laser ablation or chemomechanical agents has aided minimal invasive caries removal techniques which is the present concept. These techniques involve the selective removal of carious dentin.(3)The chemomechanical caries removal method involves softening of carious dentin by chemical agent followed by gentle excavation to remove the outermost portion (infected dentin) leaving the demineralized affected dentin that can be remineralized and repaired.(5,6) Papain gel acts on the non-covalent hydrogen bonds of the collagen structure, that are found between peptide chains and breaks the union between the collagen fibrils of carious teeth, leaving the healthy dentin intact. The Brix 3000, released in 2016 in Argentina, is derivative of fruits of green papaya. In this, concentration of papain is increased to 3000 U/mg in each 10 % andthe bio-encapsulated papain by EBE technology provides the ideal pH needed to immobilize enzymes, which leads to enhancement of proteolysis of collagen fibrils in decayed tissue, better resistance to unfavourable storage environment and greater antimicrobial properties. (7)The fear of dental treatment, commonly observed in children, is unusual anxiety brought about by visiting a dental doctor for treatment or unjustified intimidation from dental procedures. It has physiological, cognitive and behavioural implications. Different factors could provoke negative attitudes in children in their early childhood leading to increase in dental anxiety. It could be fear of dental instruments and their sound, fear of unknown environment and dental professionals, etc. The uncooperative behaviour during procedures could affect the success of the treatment and cause its impossible conduct.(8,9)CMCR method seems to be an effective alternative method in children as it is more comfortable

with less perception of pain, aiding in reducing fear and anxiety of dental treatment and instilling positive dental attitude.(2)Painless dentistry with minimal intervention helps in instilling a positive mind-set towards dental treatments, justifying the treatment for children.(8,10) The aim of this study was to assess and compare behaviour during caries excavation and patient acceptability of caries excavation procedure by Chemomechanical Caries Removal Gel and conventional drilling method on deciduous first molars in children aged 4-9 years.

Materials and Methods

Sample size was estimated, on the basis of study conducted by Harsha.S. Nalawade et al, in order to detect difference of 1.41 in the mean (Wong- Baker Faces pain scale) between the groups by assuming 95% confidence interval, 90% power, pooled standard deviation of 1.5 as 23.7. Sample size was rounded of to 24 in each group.

This split mouth study was conducted after obtaining approval (IEC/PEDO22/125/V2) from the AJIDS, Mangalore Ethics Committee. Study subjects were selected based on inclusion and exclusion criteria. Patients with atleast two open carious lesion on deciduous first molars in any two quadrants, Teeth without any evidence of pulpal, periapical or furcation pathology and opening that is large enough to allow penetration of a small excavator were included in the study. Patients with single carious lesion, teeth with pulpal exposure or bleeding during excavation procedure, pain or presence of sinus discharge, radiographic evidence of deep caries, presence of underlying systemic diseases and physically or mentally disabled patient were excluded from the study.

Clinical examination was done and preoperative radiograph was taken to assess the extent of caries. After explaining the procedure and obtaining consent, 24 patients (48 teeth) of age group 4-9 years, from the OPD, Department of Pediatric and Preventive Dentistry were selected based on the mentioned selection criteria. Carious teeth were divided in 2 groups. In group Acaries excavation was done by Chemomechanical Caries Removal gel (BRIX3000) and in group B by Conventional Drilling method. The area to be treated was isolated using sterile cotton rolls and saliva ejector. For Group A (figure 1),CMCR gel (BRIX3000) was applied with a blunt spoon excavator and left for 2 minutes. It turned darker due to decomposition of carious lesion. The decomposed dentin, which softened, was then scraped away using blunt spoon excavator in pendulum movement without pressure. Procedure was repeated until the gel remained clear indicating that the infected carious lesion is completely removed.For Group B (figure 2), caries removal was done using a high speed hand piece with a round carbide bur. The cavity was examined by tactile sensation and visual inspection to check for remaining caries. Treatment was done on two different appointments. The child was asked to raise hand if the pain on caries excavation became unbearable and informed that anaesthesia may be given if necessary. Venham Behaviour Rating Scale(11,12) was used to describe child's behaviour during treatment. Evaluation was done by another person in dental operatory during caries excavation procedure. The Wong-Baker Faces Pain Scale (WBFPS)(12) was used to assess patients' acceptability after treatment. The tooth was then restored with GIC.

The data was collected, coded and fed in SPSS (IBM version 23) for statistical analysis. The descriptive statistics included frequency, percentages, mean and standard deviation. The inferential statistical test included Chi square test for comparison of categorical

data. The level of significance was set at 0.05 at 95% confidence interval.

Results

Table 1 depicts mean age and gender wise distribution of the study population with mean age of the children being 6 ± 1.57 years. 13 were males (54.2%) and11 were females (45.8%) among study population. Table 2 and graph 1 depicts comparison of patient behaviour among study population between group A, chemomechanical caries removal agent and group B, conventional drilling. No statistically significant difference was found in patient behaviour between two methods. Table 3 and graph 2 depicts comparison of patient acceptance between CMCR method and conventional drilling method. Highly significant difference was observed among two groups. In Group A, 54.2% (n=13) children felt no hurt, 37.5% children (n=9) felt little bit hurt and 8.3% children (n=2) felt little more hurt while in Group B, 4.2% (n=1) children felt no hurt, 58.3% children (n=14) felt little bit hurt and 37.5% children (n=9) felt little more hurt. Thus, Group A i.e, CMCR was better accepted by children than Group B i.e, the conventional drilling method. Patient behaviour among 6 years and below age among two groups were assessed and analyzed. No statistically significant difference was observed in patient behaviour among two groups. But comparison of patient behaviour among 7 years and above age group between two groups showed statistically significant difference in patient behaviour. Among 7 years and above age when children were treated with CMCR method, they showed total cooperative behaviour than during conventional drilling method.

Discussion

Dental caries is a multifactorial disease that leads to destruction of tooth structure resulting in cavitation. Treatment of dental caries, especially in children is a challenging task.

The purpose of this study was to assess and compare behaviour during caries excavation and patient acceptability of caries excavation procedure by Chemomechanical Caries Removal Gel and conventional drilling method on deciduous first molars in children aged 4-9 years.

Conventional drilling is the traditional method followed for caries excavation, but with number of disadvantages. The present concept of treating a dental cariesis “prevention of extension” for preserving healthy tooth structure which aims to remove only infected carious tooth structure preserving remaining natural structure.(13,14)There are number of ways for minimal invasive caries removal. Chemomechanical caries removal method is one such method which uses chemical agent to soften and remove the infected carious dentin without extending to affected dentin(15,16).

Particularly, considering children, the sight, sound and vibration felt of aerotar is usually unacceptedand may create objective fear in them. Also occasionally, tendency to close the mouth during treatment may lead to lacerations of mucosa. (8,9)The mode of treatment delivered can affect childs attitude towards dental treatment. Also, a child with dental fear leads to disruptive behaviourleading to compromised treatment delivered to the child hampering the prognosis.(8)Yuthi M et al concluded that the procedures using aerosol techniques are more anxiety provoking, may be because of the vibrations and high pitch noise of airotor used. This frequently leads to the treatment avoidance by children.(17)

CMCR agents can be used effectively in anxious young patients reducing the dental fear in children. It can also be used in management of mentally or physically

challenged children. There are wide variety of CMCR agents that have developed over time. Brix 3000 is a type of papaya based enzymatic gel based CMCR gel derived from fruits of green papaya.(4,18).

The results obtained showed that there was better acceptability of CMCR method compared to the conventional drilling method by the study population but no statistically significant difference was found in behaviour.A study conducted by M.M. Alkhouli et al(4), concluded that the CMCR agents are effective in removal of carious part of primary teeth without affecting children's cooperation. However, conventional drilling technique is much faster in the excavation of caries.A study conducted by S. Rajkumar et al(19)concluded that the time taken for caries removal by carie care, CMCR method was more followed by other hand excavation and aerotar methods, but all the three methods removed caries effectively; however, the highest efficacy of caries removal was with airotor followed by comparable effectiveness by carie care method and the minimal by hand instruments. Also, the patients' pain experienced during caries removal was found to be least with carie care followed by hand excavation and then aerotar.

Similar to the result obtained in this study, study conducted by Rehab Mohamed Salah Kotb et al(20), on 5-9-year-old children comparing Papacarie gel, CMCR with conventional drilling method, concluded Papacarie can be an effective method of caries removal to treat children, particularly those who present with early childhood caries or management problems. Zornitsa Lazarova et al(8) conducted a study to assess fear in 4-6 years old children, concluded that Brix 3000 could be successfully implemented on children with a strong or weak negative attitudes as per Frankl; and the sparing enzyme-based excavation lowered fear levels in relation to the conventional bur treatment.Amitha M. Hegde et al(21), concluded by a studythat CMCR technique though time consuming is definitely superior compared to conventional technique in pediatric dentistry, provided less technique sensitive restorative material which retains on the teeth for longer period of time is used.

Contradicting to the results of this study, T. F. de Souza et al(13), concluded that ART with Brix3000, was found to require longer treatment times, which can be considered an inconvenience in children's dental treatment and there were no differences in either pain experience or acceptability.

Most of the studies are in support of the results obtained in this study. The CMCR technique is better accepted by the children compared to conventional drilling. This study results depicts CMCR method to be effective in children as young as 4 years, which is the initial time of dental visits, thus instilling positivity towards dental treatment.(22)Though CMCR method is time consuming according to many previous studies(13), it is better accepted by children and can be considered as an alternative for the conventional drilling method.

Split mouth designenabled the proper selection of the satisfying method according to the patient by assessing both the methods on same child on different days. The assessing of behaviour before, during and after treatment would have provided better results. Questionnaire including multiple questions that would assess the feeling of patient would have provided additional aid in concluding the study. Uneven gender distribution could have affected the results.Further studies can include comparison of CMCR with other minimal invasive method of caries excavation. Also, a study with larger sample size, including assessment of residual caries after excavation, microbial analysis of carious tooth structure

and follow up is advised to provide a better picture regarding efficacy of the CMCR agent.

Conclusion

Based on findings of this study it can be concluded that chemomechanical caries removal method of caries excavation was better accepted by children than the conventional drill method. CMCR method can be an alternative method to conventional drilling for caries excavation, especially in younger children helping to reduce dental anxiety and in still positive dental attitude. Alleviating dental fear at young age promotes better future oral health care.

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Legend Tables and Figures

Table 1: Age and Gender wise distribution in the study population.

		Descriptive statistics
Age	Mean	6.0417
	Standard deviation	1.57367
Gender	Male	13(54.2)
	Female	11(45.8)

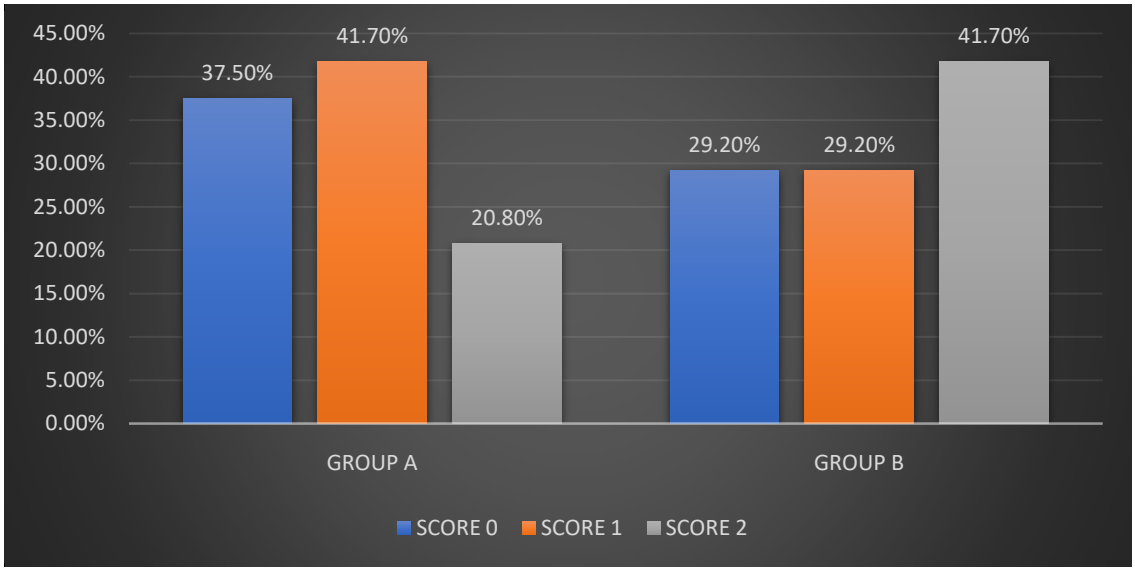
Table 2: Comparison of patient behaviour among two groups of the study population.

PB	Score 0	Score 1	Score 2	Chi square value	Sig. s
Group A	9(37.5)	10(41.7)	5(20.8)	2.446	0.294(NS)
Group B	7(29.2)	7(29.2)	10(41.7)		

Table 3: Comparison of patient acceptance among group A and B of study population.

PA	Score 0	Score 1	Score 2	Chi square value	Sig. s
Group A	13(54.2)	9(37.5)	2(8.3)	15.827	0.000(HS)
Group B	1(4.2)	14(58.3)	9(37.5)		

Graph1: Graphical representation of patient behaviour among group A and group B.



Graph 3: Graphical representation of Patient acceptance among 2 groups.

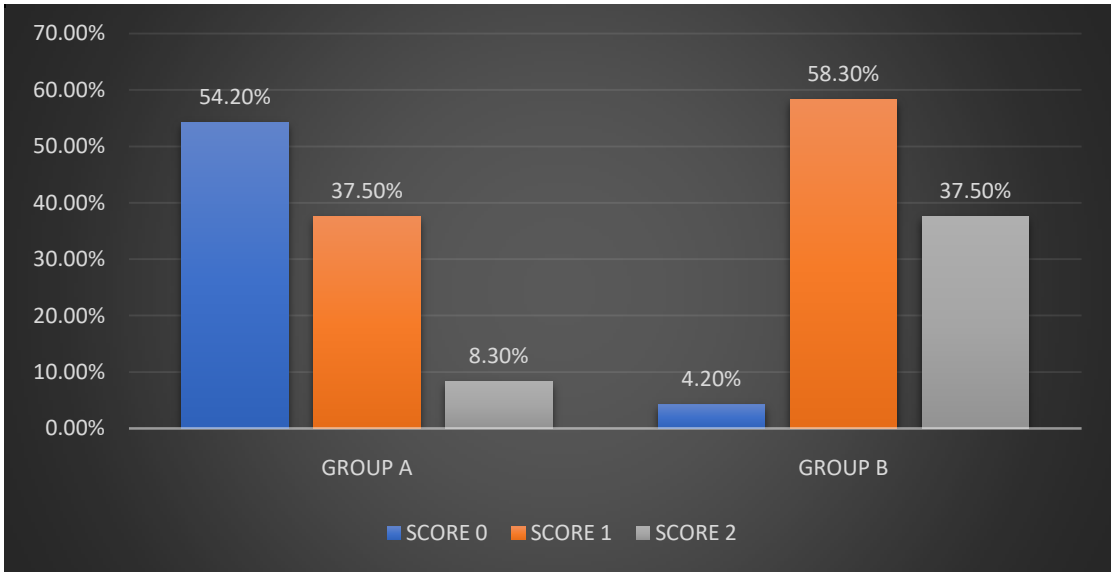


Figure 1: Caries excavation with CMCR method

Figure 2: Caries excavation with conventional drill method.