

Smart Bur: A New Magical Tool in Pediatric Dentistry in Contrary to Carbide Bur

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Abstract

Background: Conventional cavity preparation and caries removal methods use mechanical means mostly burs, these are often associated with pain and fear, especially among children. Moreover, these techniques present the risk of easily removing healthy dental tissues or damaging the pulp through temperature rise, this may be the origin of discomfort. Minimally invasive technology can be an improvement while addressing these tribulations, confines the use of dental drill, thus improving patient acceptance for treatment. The aim of the study is comparative evaluation of pain perception and behavior during carious dentin excavation using Smart burs and conventional carbide bur.

Materials and Methods: Randomized controlled clinical study was performed on 30 children-aged 6–10 years, who presented with bilateral occlusal carious lesions on primary molars. Sixty primary molars were randomly divided into two groups (30 – Smart bur group/30 – carbide bur group) and caries excavation followed by glass-ionomer cement restoration was performed. Wong Baker Facial Pain Rating Scale was used to evaluate pain experience by the patients and Venham's Behavior Rating Scale was used to evaluate the patient Behavior for both groups. Statistical analysis was done using Wilcoxon Signed-Rank Test. $P < 0.05$ was considered as significant. **Results:** The results revealed statistically significant differences between the Smart burs (Polymer burs) and conventional carbides burs with respect to patient behavior ($P < 0.005$) and the pain perception for caries removal ($P < 0.005$). Among both groups, smart bur proved more effective compared to conventional carbide bur.

Conclusion: Smart bur is more efficacious in terms of improved patient behavior and reducing pain score compared to the carbide bur. Patient acceptance, comfort level, and Behavior was found to be improved with smart bur compared to conventional carbide bur. Combined use of chemomechanical method with conventional carbide bur method demonstrated higher rating of behavior and pain score compared to Smart bur.

Keywords: Conventional carbide bur, Pain perception, Patient behavior, Smart bur.

INTRODUCTION

“Preservation of a healthy set of natural teeth for each patient should be the objective of every dentist. Loss of even a part of human tooth should be regarded as a serious injury, never to be considered lightly, and the tooth is certainly worthy of the most careful restoration.”^[1] In every field of dentistry, knowledge of the importance of preserving tooth tissue, combined with a patient responsive approach, is becoming self-evident. The best way to ensure maximum life for the natural tooth is to respect the sound tissue and protect it from damage using Minimally Invasive techniques in restorative dentistry.^[2]

Dental caries is considered to be one of the most serious dental diseases that result in localized dissolution and destruction of the calcified tooth tissues and eventually leading to the infection of the dental pulp when left untreated.^[3] Due to

constant advancement in mechanical and adhesive properties of dental filling materials, the excessive tooth cutting required to obtain resistance and retention form in conventional cavity preparation is minimized. Conventional views of extension for prevention with rotary instruments are replaced by the Minimal Invasive Dentistry (MID) practices.^[4]

The primary aim of MID in restorative dentistry is to remove only the outer layer of highly infected, denatured caries infected dentin. This facilitates the preservation of the inner layer of

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intact, bacteria-free affected dentin and prevents disease progression.^[5] Conventional Carbon Steel Burs are considered to be the gold standard, because these burs enjoy the patronage of most of the dental practitioners. A novel, recently proposed, self-limiting concept in mechanical caries removal has arrived with the introduction of a polymer bur, (“Smart Prep-II®,” SS White Burs, Lakewood, USA).^[6] Smart Prep® bur is made of a polyamide/imide polymer with a specific hardness of 50 KHN, which is higher than the hardness attributed to carious dentin, but lower than that of sound dentin.^[7]

A review conducted by Cardoso *et al.* for pain perception and behavior management, 14 studies assessed the patients pain perception or behavior during the intervention. Patients receiving alternative approaches for caries lesions showed significantly better treatment experiences and fewer signs of discomfort or pain during the consultation in ten studies. Only one study revealed similar pain experience between groups.^[1]

The purpose of this clinical study was to evaluate and compare the pain perception and patient behavior during excavation of carious dentin using a Smart burs and conventional carbide bur in conjunction with chemomechanical methods.

MATERIALS AND METHODS

Present randomized clinical trial was performed after obtaining approval of IRB among 30 children aged 6–10 years, who presented to outpatient department of Pediatric department with bilateral occlusal carious lesions on primary molars.

Carious teeth with only dentinal involvement as evidenced by digital radiographs were included and pulpal involvement and periapical lesions with buccal/palatal/proximal/cervical carious lesions were excluded. Subjects who were uncooperative/physically/mentally challenged were also excluded from the study.

Patients were selected based on the inclusion criteria and after informed consent was obtained from the parents. The selected carious teeth in each patient were randomly (Chit pick method) assigned to one of the following groups: Smart Bur Group (Group-A) (SS White, Lakewood, N.J., USA) or Conventional Carbide Bur (Group-B). All procedures were performed without local anesthesia. Preoperative radiographic assessment to ensure caries extension was limited to dentinal levels was followed by removal of caries in enamel with high-speed handpiece and diamond bur to establish proper access. The cavity was cleaned with cotton pellets. Application of Chemo Mechanical Gel (CARIE-CARE®) in both groups for 20–30 s following the manufacturer’s instructions. Caries excavation in all the teeth was terminated when all the soft dentin was removed. Following the application of Chemo Mechanical Gel, the caries in teeth of Group A patients was excavated using Smart Burs. Smart prep (Polymer bur) size #2, 4, 6 depending on cavity size, running at low speed (500–800 rpm) in micromotor handpiece. The caries removal of Group B patients was accomplished with conventional carbide

bur, at slow speed (500–800 rpm) in micromotor handpiece. The study subjects completed the Wong Baker Facial Pain Rating Scale (WBFPS). Where ever deemed necessary, a Calcium Hydroxide Base (Dycal®) application followed by glass-ionomer cements (type 2) as restoration was performed. An independent observer assessed the patient behaviors using the Venham’s Behavior Rating Scale (VBS). (baseline, during and after the procedure).

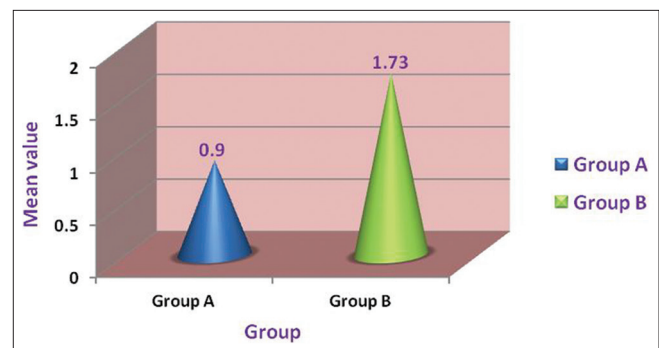
Statistical analysis was done using SPSS version 20.00. Data were collected and statistically analyzed using Wilcoxon Signed-Rank Test. $P < 0.05$ was considered as significant.

RESULTS

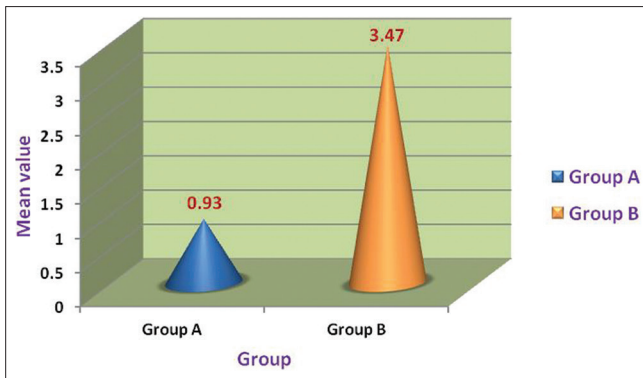
The present study conducted to compare and evaluate the pain perception and behavior during carious dentin excavation using Smart burs and Conventional Carbide bur. Among the selected 30 patients, 13 were male and 17 were female, with ages in the range of 6–10 years. Majority of the study subjects were of 7 years (33.3%) followed by 8 years (26.7%), 6 years (23.3%), and 9 years (16.7%), respectively. Mean age of study subjects was 7.36 ± 1.03 year. Mean age was 7.00 ± 1.08 years for male subjects and 7.65 ± 0.93 years for female subjects.

Intergroup comparison of behavior score (During procedure) for caries removal and patient acceptance by Smart bur and Conventional carbide bur was performed to assess the pain perception during caries excavation in pediatric patients. The results showed a statistically significant difference ($P \leq 0.05$) between these groups. Behavior score during procedure was lower in Group A (0.90 ± 0.54) than Group B (1.73 ± 0.58). Statistically, significant difference was present in behavior score between Group A and Group B (Graph 1).

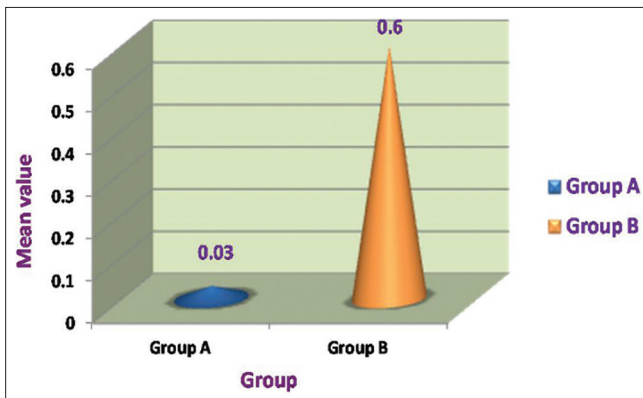
Intergroup comparison of behavior score after procedure between Group A (Smart bur) and Group B (conventional Carbide Bur) with Wilcoxon Signed-Ranks test revealed, behavior score after procedure was lower in Group A (0.03 ± 0.18) than Group B (0.60 ± 0.49). Statistically, significant difference was present in behavior score between Group A and Group B (Graph 2). Intergroup comparison of pain score between Group A and Group B was assessed using WBFPS. Analysis to evaluate pain perception of patient using Smart



Graph 1: Intergroup comparison – behavior score Groups A and B (during procedure)



Graph 2: Intergroup comparison – behavior score Groups A and B (after procedure)



Graph 3: Intragroup comparison – pain score – Groups A and B

bur (Group A) and Conventional Carbide bur (Group B). Pain score was reduced in Group A (0.93 ± 0.69) than Group B (3.47 ± 1.07). Statistically significant difference was present in pain score between Group A and Group B (Graph 3).

Overall clinical finding of present study shows that Smart bur was more effective in reducing patient fear and anxiety by reduced Behavior and Pain Score as compared to Conventional Carbide Bur.

DISCUSSION

Modern dentistry has evolved into MI approach.^[8] The concept of prevention, remineralization, and nominal intervention is the basis for the concepts of MID. This achieves the treatment objectives using the least invasive surgical approach, with the removal of the minimal amount of healthy tissues.^[9] Research to avoid or at least minimize, the adverse effects produced by drilling instruments have prevailed for several years.^[10] Hence, the newer techniques of caries removal such as Carisolv and Polymer burs that work on the principles of MID have found preference.^[5] DW Boston, in 2003, developed an alternative method of dentine caries removal by bringing a new concept of Polymer prototype bur. Smart Burs with reinforced blades, property of self-limitation, are used with a slow-speed handpiece and anticipated to selectively excavate only carious degraded dentine.^[11]

Obtaining an accurate measurement of pain is vital to gauging response to therapy. WBFPS is preferred as it is easier to understand and to translate pain experience by the children. However, the VBS presents significant advantages as raters can be readily trained to use the scale, and it is easily integrated into clinical activities and research designs. Behavior rating score between Groups A and B (During and After Procedure) revealed that patients were more comfortable in Group A compared to Group B. Pain assessment was done by WBFPS, the score was lower in Group A than Group B suggested that caries excavation was less painful with Smart burr.

The present study results concur with other studies done by Soni *et al.*^[5] who observed mean VAS scores for the air-rotor group, spoon excavator group, Carisolv™ group, Polymer burs, and concluded that Carisolv™ group was the least painful method for caries excavation followed by Polymer burs. Isik *et al.* compared the caries removal efficiency of polymer burs (Smart burs) and conventional carbide burs microbiologically and found polymer burs to be as effective as the conventional carbide burs in caries removal.^[7] Prabhakar and Kiran, in another study, proved that carbon steel round burs removed caries lesions more efficiently than polymer burs, but they contributed to the overpreparation of the cavity.^[3]

Apprehensions associated with dental procedures are not always relieved on completion of the treatment. Assessment of behavior score post-procedure would indicate the comfort levels of the patient and their ability to cope based on the maturity of the child. The study revealed statistically significant difference ($P \leq 0.05$) in behavior rating score between Groups A and B (During and After Procedure). The finding shows that behavior score during and after procedure was less in Group A (0.90 ± 0.54) as compared to Group B (1.73 ± 0.58).

It is established that caries excavation by Smart bur is superior than other caries excavation methods. Kumar *et al.* established that time taken for caries excavation with Carie-care is higher compared to Smart bur and time taken by Smart bur greater than Carbide bur.^[12]

From above findings, present *in vivo* study demonstrated that Smart burs could be the feasible alternative methods in pediatric dentistry owing to their efficacy and being minimally invasive techniques of effective caries removal. Overall, among two caries excavation methods, Smart burs illustrated better patient acceptance, comfort, and lower pain perception compared to Carbide bur.

CONCLUSION

The following conclusions were drawn from the study:

- Patient Acceptance, Comfort level, and Behavior was found to be higher with Smart bur compared to Conventional Carbide bur
- Pain score according to patients experience during carious dentin excavation was found to be maximum with Conventional Carbide bur and least by Smart (Polymer) bur

- Chemo mechanical methods appear to be the greatest alternative for minimally invasive therapies, with good control over their administration and activity, as well as positive patient treatment experiences. Patients reported more enjoyable treatment experiences with alternative therapy techniques, as well as greater percentages of acceptance and desire for alternative ways in future treatments.

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