

## EFFECT OF METHYLPHENIDATE ON BEHAVIOR OF ATTENTION DEFICIT HYPERACTIVE DISORDER (ADHD) CHILDREN DURING DENTAL TREATMENT

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### **ABSTRACT**

**Objectives:** The study objective was to assess the effectiveness of methylphenidate on the behavior of children with attention deficit hyperactive disorder during dental treatment.

**Methods:** Forty children aged from 4-8 years were divided equally into two groups. Before any dental procedures, patient preparation and familiarization appointment was arranged to provide them with an opportunity to meet the dentist and office personnel in a relaxed environment. In group A (drug group) dental procedures were done after the use of the methylphenidate drug. In group B (control group) dental procedures were done without the use of the drug. Local anaesthesia injection then pulpotomy and stainless-steel crown were accomplished. Behavior during dental treatment was assessed using the Frankel behavior rating scale.

**Results:** The results of this study revealed that there was a statistically significant difference in behavior between both groups, with more positive behavior in Group A.

**Conclusion:** The use of methylphenidate with attention deficit hyperactive disorder children before dental treatment helps in behavior management and makes the child more cooperative during dental treatment.

**KEYWORDS:** Behavior, Methylphenidate, ADHD, Frankel Behavior Rating Scale

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## INTRODUCTION

In dental practice, it is often observed that many children do not cooperate during dental procedures, making it challenging to manage them<sup>(1)</sup>.

To attain a cooperative child during dental treatment, it is crucial to try to alter or influence the child's behavior pattern. Various behavior management strategies are employed to address these underlying factors<sup>(2)</sup>. These strategies encompass verbal and nonverbal communication, the "tell-show-do" approach, distraction techniques, the presence or absence of parents in the clinic, modelling, the use of audiovisual aids, positive reinforcements, physical restraints, the hand-over-mouth exercise, sedation, and general anesthesia<sup>(3)</sup>. Behavior management methods in paediatric dentistry are primarily focused on either maintaining the communication process or eliminating inappropriate behavior<sup>(4)</sup>.

Children with special needs may experience more anxiety about dental treatment compared to those without a disability<sup>(5)</sup>.

Children with ADHD may struggle with paying attention, impulsivity, and resulting behavioral problems. They are more susceptible to trauma and frequent dental injuries. The behavioral challenges, cognitive deficits, and short attention spans present a significant challenge to the dental health team. Management of these children requires several pharmacological and non-pharmacological approaches at all levels of dental maneuvers<sup>(6)</sup>.

The first line of pharmacological treatment for ADHD is psycho-stimulants such as amphetamines and methylphenidate<sup>(7)</sup>.

Methylphenidate is considered the most effective, safe, widely used treatment for ADHD and is considered the most recommended option for ADHD children<sup>(8)</sup>.

Methylphenidate has been shown to improve social behavior and cognitive performance in

children with ADHD<sup>(9)</sup> and improve inattention, hyperactivity, and impulsivity symptoms<sup>(10)</sup>.

Until these days, little knowledge about the use of methylphenidate for the management of ADHD children during dental treatment was obtained, therefore the current study was conducted to evaluate the effectiveness of methylphenidate on behavior of ADHD children during dental treatment.

## SUBJECTS AND METHODS

### Ethical regulations:

Ethical approval was obtained from the ethics research committee of the Faculty of Dentistry, Minia University (reference no.680\ 2023). All procedures were explained in detail to the child's parents/ legal guardian then they signed informed consent when they agreed to participate in the study.

### Study design:

The current study was designed as a randomized controlled trial.

### Sample size calculation

The sample size was estimated using the online epi tools program for "Prospective, cohort, and randomized clinical trials studies"<sup>(11)</sup>.

### Randomization and Allocation:

An independent clinician generated a concealed allocation sequence using a computer-based block randomization technique, ensuring that participants were equally distributed into two groups<sup>(12)</sup>.

**Case selection:** Forty children were selected for the study to fulfill the following criteria.

### Inclusion Criteria:

1. Children primarily diagnosed with ADHD.
2. Children with ages ranging from 4 to 8 years.
3. Children with deep caries who needed dental treatment (pulpotomy).

4. Parents and/or children seeking dental treatment under local anesthesia.

**Exclusion criteria:**

- 1- Children who were administrating other psychostimulant drugs.
- 2- Children undergoing previous dental visits.
- 3- Children with any psychotic or neurologic condition.
- 4- Hypersensitivity or Anaphylaxis to any components of the drug.

**Informed consent:**

All patients and their guardians were briefed about the treatment procedures in a simple and detailed manner, the expected outcome of the current treatment, the possibility of non-cooperation of the child during work, and other treatment modalities. All children/parents who agreed to participate in the study provided verbal consent and the parents signed the Ethical Regulations Committee of the Faculty of Dentistry/Minia University consent form.

**Grouping:**

All children who fulfilled inclusion criteria and exclusion criteria were randomly assigned into two groups. For group A, dental procedures were performed using methylphenidate drug. It was given one hour before starting the operative procedure to allow for optimum effect. For group B, dental procedures were performed without using methylphenidate drug.

**Preparation procedures:**

Getting children ready for dental care at home before their visit can greatly improve their dental appointment experience.

**Study procedures:**

The procedures were conducted in three successive sessions by the same pediatric dentist for the child who fulfilled all the above criteria as following

**First dental session:**

Personal data, medical and dental history, and clinical and radiographic examination were done.

**Second dental session:**

Before the second dental session, the parent and caregivers were instructed to give the child the starting dose of methylphenidate drug, (Concerta 18 mg, ALZA corporation, USA) one hour before dental treatment for group (A)

**Steps:**

Topical anaesthetic gel (Dr.numb, JK company, Egypt) was applied followed by inferior alveolar nerve block achieved by 2% mepivacaine with levonordefrin 1:20,000, (Mepecaine-L, Alexandria company, Egypt) .Rubber dam isolation was applied. Pulpotomy procedures using mineral trioxide aggregate, (MTA, Well Root, vericom, South Korea) were performed. Chemical cured glass-ionomer restoration, (Medifil, promedica, Germany) was applied followed by application of a proper size stainless steel crown.

**Post-operative instructions/parent counselling**

All patients and/or parents were instructed to take care of lip biting due to anesthesia administration, give the child the described analgesic if there was some sort of pain or discomfort after treatment as well as avoid sticky food

**Child assessment:**

During dental examinations, each child's behavior was assessed using the Frankl behavior Rating Scale. <sup>(13)</sup>.

*This scale has four categories:*

- 1: **Definitely negative:** refusing the treatment, sobbing loudly, acting afraid, or displaying any other overt signs of strong negativity.
- 2: **Negative:** unwilling to comply with treatment, uncooperative, mildly unfavorable attitude but not overt, such as being withdrawn or sullen.

3: **Positive:** Despite occasional moments of caution, the child cooperated with the dentist and followed their instructions patiently.

4: **Definitely positive:** A good relationship with the dentist, curiosity about the dental treatments, humor, and enjoyment of the circumstances.

Accordingly, once the session was ended, the operator filled in the Frankl behavior rating scale to assess the global behavior of the patient after treatment.

For statistical analysis of obtained data, rating 1 and rating 2 combined in one category were called negative while rating 3 and rating 4 combined in one category were considered positive.

**RESULTS**

Results of the present study showed that children who participated in the current study ranged in age from 4 years to 8 years with mean age  $5.9 \pm 1.2$  years and  $6.2 \pm 1.2$  years for group A and group B respectively. They were 45% males and 55% females in group A and 55% males and 45% females in group B. Analysis of data regarding the distribution of age and sex revealed no statistically significant difference between both groups excluding further mentioned confounding factors indicating that the both groups were comparable. Table (1), figure (1), (2)

TABLE (1) Distribution of age and sex between two groups.

		Group		P value
		A	B	
		N=20	N=20	
Age	Range	(4-8)	(4-8)	0.362
	Mean ± SD	$5.9 \pm 1.2$	$6.2 \pm 1.2$	
Sex	Male	9(45%)	11(55%)	0.527
	Female	11(55%)	9(45%)	

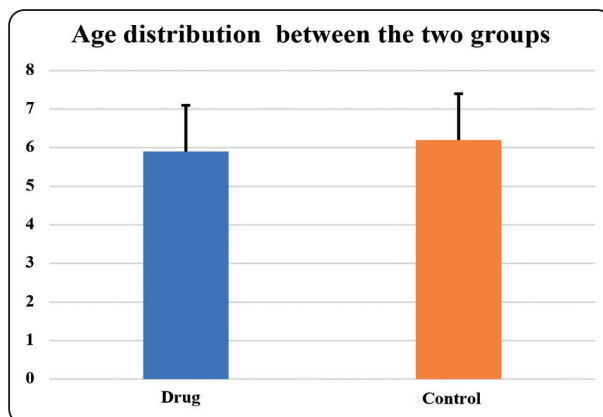


Fig. (1) Age distribution between the two groups

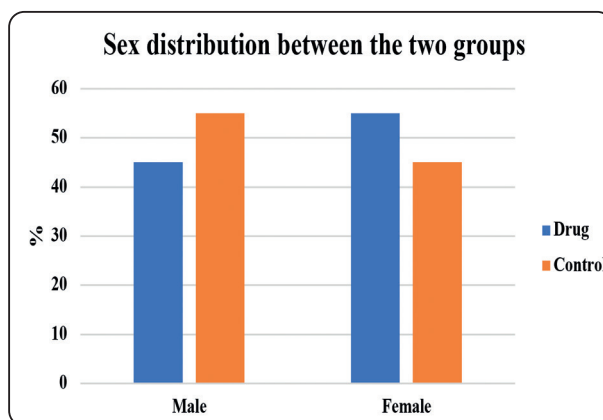


Fig. (2) Sex distribution between the two groups

**Statistical data analysis:**

The Independent Samples T-test was employed to compare parametric quantitative data between the two groups while Categorical variables were analyzed using the Chi-square test and Fisher’s exact test.

**Assessment of behavior between both groups:**

Analysis of data regarding behaviour between groups A and B showed that there was a statistically significant difference in behavior between both groups, with more positive behavior in the drug group (group A). Table (2) figure (3)

TABLE (2) Behaviour assessment between the two groups

		Group		P value
		A	B	
		N=20	N=20	
Behaviour	-Ve	4(20%)	17(85%)	<0.001*
	+Ve	16(80%)	3(15%)	

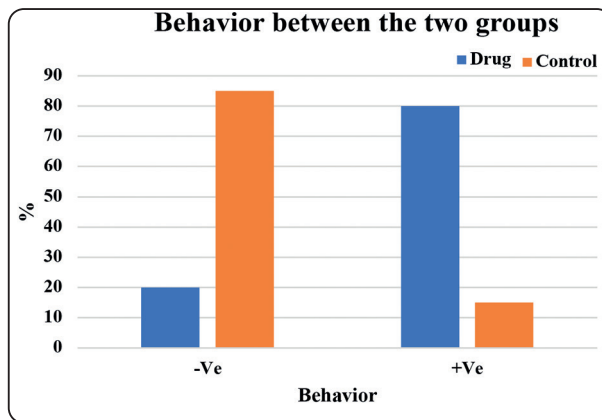


Fig. (3) Behavior between the two groups

## DISCUSSION

Recently, few studies have been conducted to evaluate the efficiency of methylphenidate for the management of ADHD children during dental treatment, therefore the current study was conducted to evaluate the effectiveness of methylphenidate on behavior of ADHD children during dental treatment.

The ages of children in this study were between 4 and 8 years. This was because treating dental problems in this age group can be more challenging due to several factors. These factors include increased difficulty of managing their behavior, higher prevalence of dental anxiety, greater complexity in treatment delivery<sup>(14)</sup>, the time of exfoliation of the primary first molar is 9-11 years while the second primary molar is 10-12 years<sup>(15)</sup>.

Inclusion criteria involved only children who were medically free to avoid any interference with the studied drug. Additionally, children with chronic disease could not cooperate like his peers<sup>(16)</sup>.

The study excluded children who had previously visited a dentist because they might be more likely to experience dental anxiety and difficulty of cooperating<sup>(17)</sup>.

Two visit treatment was done to minimize children experience to local anesthesia, reduce discomfort and ensure the fewest possible overall appointments<sup>(18,19)</sup>. To get better cooperation from the children the morning appointment was scheduled to ensure that visit wasn't in times of naps and meals as this was recorded may affect children's mood and make them less likely to cooperate<sup>(20)</sup>.

In this study the Frankl Behavior Rating Scale, a gold standard tool known for its reliability in assessing children's behavior during dental treatment was employed. This scale categorizes children's behavior based on their cooperativeness and overall attitude throughout the procedure<sup>(21) (22)</sup>.

The results of the current study revealed both groups comparable regarding age and gender but there was a statistically significant difference in behavior between both groups, with more positive behavior in Group A. This was attributed to methylphenidate increasing dopamine and norepinephrine which reduces physical and cognitive impulsivity and improves sustained attention which in turn enhances dental management<sup>(6)</sup>.

Regarding the comparison of the current study results with previous studies, few published clinical trials concerning the effect of methylphenidate on ADHD children in the dental field were found.

The current study goes in agreement with Kausar et al. (2018)<sup>(23)</sup> and Gudadhe et al. (2019)<sup>(24)</sup>, who concluded that the use of methylphenidate drug was effective in improving the behavior management of children with ADHD during dental treatment. Our finding contradicted the results of Grizenko et al. (2006)<sup>(25)</sup>, who reported that methylphenidate was much less effective in improving the behavior of children with ADHD. This difference can be attributed to differences in the age groups, doses of methylphenidate and different behavior rating scales.

However, limitations of the current study included difficulty of ADHD diagnosis and categorization into subtypes which might lead to misdiagnosis. Moreover, other limitations were related to methylphenidate drug which is supplied as tablets with difficult swallowing in addition to its high cost <sup>(26)</sup>.

## CONCLUSIONS

The use of methylphenidate for attention deficit hyperactivity disorder children undergoing dental treatment have positive effects regarding improving behavior management during dental treatment.

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