

The Prevalence of ADHD Patients among Pediatric Dentists in Israel and Knowledge of Dental and Behavioral Aspects of Treating Them

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Objective: There are no clear guidelines for managing the dental treatment of children with attention deficit hyperactivity disorder (ADHD). The use of sedation in combination with chronic ADHD medication use is also not well defined. This study surveyed the prevalence of ADHD children, management techniques and knowledge of pharmacologic therapies of these children among Israeli dentists. **Study Design:** A specially designed questionnaire was distributed to all Israeli dentists attending a national conference in 2016. **Results:** Of the 160 dentists who attended the conference, 96 completed the survey (60% response rate), and they included 46 (51%) pediatric dental specialists and 50 (49%) general dental practitioners. The medications Ritalin and Concerta were most familiar to the respondents (98.9%). Eighty-seven (91.1%) of the practitioners responded that their ADHD patients take their usual doses of any drug for treating ADHD symptoms, regardless of whether or not the dentists intended to use sedatives. The practitioners invented their own behavior management techniques with varying degrees of success. **Conclusions:** There are no specific guidelines for the most effective pharmacologic protocol (co-administration of ADHD drugs and dental sedatives) or behavior management techniques for the provision of optimal dental care to children with ADHD.

Key words: ADHD, dental care, pharmacologic management, behavior management, survey

INTRODUCTION

Attention deficit hyperactivity disorder (ADHD) is defined by the American Psychiatric Association as a lifelong neurodevelopmental disorder that often becomes apparent before the age of 7 years.¹ The characteristic features of ADHD include excessive motor activity, developmentally inappropriate activity level, low frustration tolerance, impulsivity, poor organizational behavior, distractibility, and inability to sustain attention and concentration.²

The exact cause of ADHD is unknown. Brain imaging studies suggest that there is smaller total cerebral volume as well as reduced global and local activation of the basal

ganglia and the anterior frontal lobe in patients with ADHD.¹⁻³ Prevalence of this neurologic disorder has been reported to be as widespread as 2-18% of the population.⁴ Since more children are being diagnosed with ADHD today than ever before, appropriate treatment strategies for them are of great interest to all caregivers, including those in the dental community.

Most children being treated for ADHD are managed with a combination of behavioral and pharmacologic therapies. Current drugs employed in the treatment of ADHD include prescription stimulants and non-stimulants. The more prominently prescribed stimulants are:

1. methylphenidate (Ritalin®, Novartis Pharmaceuticals UK, England)
2. dextroamphetamine (Dexadrine®, Ashton Pharmaceuticals Ltd, Vale of Bardsley, Ashton-under-Lyne, UK)
3. amphetamine salts (Adderall®, Shire Pharmaceuticals, Basingstoke, Hampshire, England)
4. sustained-release methylphenidate (Concerta®, JANSSEN -CILAG Pty Ltd, New Zealand, Australia)
5. a combination of saccharate dextroamphetamine, monohydrate aspartate, amphetamine sulfate and dextroamphetamine sulfate (Attent®, Barr Laboratories, Forest, USA) .

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The non-stimulant drugs include:

1. atomoxetine (Strattera®, Eli Lilly and Company Limited Hampshire, UK)
2. clonidine ER (Kapvay®, Shionogi Pharma, Inc., Atlanta, USA)
3. guanfacine ER (Intuniv®, Shire Pharmaceuticals Limited, Hampshire, UK).⁵

Although stimulants still remain the first line of treatment, there is a growing trend towards the use of non-stimulants, especially if their effect on symptoms is not adequate or if they are not tolerated. They may also be contraindicated for a given patient. While stimulants can be very effective in reducing symptoms of ADHD, some patients may experience uncomfortable or harmful side effects, such as sleep problems, decreased appetite, delayed growth, headaches and stomach aches, rebound (irritability when the medication wears off), tics, moodiness and irritability.⁶

ADHD medications can be categorized according to their release formula into short-acting formulas which are released immediately and last about 4 hours (such as methylphenidate [Ritalin]) and long-acting formulas, which release the medication gradually and last up to 14 hours (such as sustained-release methylphenidate (Concerta)).⁷

Dental Management Implications

Treating the ADHD patient in the dental office requires knowledge of health history/medication complications, recognition of possible unique oral presentations, and flexibility in adjusting the treatment plan.^{8,9} There are significant pharmacological effects that must be considered by the dental professional before deciding upon treatment, among them xerostomia (dry mouth), loss of smell acuity, sinusitis, dysgeusia, sialadenitis, stomatitis, glossitis, discolored tongue, bruxism, dysphagia, elevated blood pressure and heart rate.¹⁰ Since xerostomia has been reported as a side-effect of methylphenidate, it may contribute to a higher prevalence of dental caries. Saliva production, the body's natural protection system against caries, may be reduced by these medications, and a reduction in saliva flow is considered to be a risk factor for dental caries.^{4,11} Furthermore, children with ADHD who have a high consumption of soft drinks may be even more vulnerable to caries than children in the general population.¹²

Anxiety and behavior management problems are common in children with ADHD.⁴ These children are more vulnerable to coping problems in challenging situations, such as that of the dental treatment, due to their impaired cognition and higher rate of learning disorders.¹³ Additionally, ADHD affects an individual's ability or motivation to maintain appropriate oral hygiene, and this is associated with a higher caries experience.¹⁴ Broadbent et al. found that children with ADHD had nearly 12 times the odds of having a high DMFT (D;d-Decay, M;m-Missing; F;f-Filled, T;t-teeth) score than children who did not have ADHD.⁴ On the other hand, Hidas et al. found that there was no difference in DMFT/dmft scores despite the higher plaque index and lower salivary flow of

children with ADHD compared with healthy children.¹⁴ A population-based survey study by Lalloo¹⁵ showed that hyperactivity was significantly associated with the occurrence of major injuries affecting the face and/or teeth. It has also been suggested that an important feature of ADHD is accident proneness and the likelihood of increased violence, which may occasionally put children with ADHD at risk of serious dental injury.

A comprehensive medical history needs to be completed on each patient in dental practice, and this is especially relevant to patients diagnosed with ADHD. Medical histories should include specific questions on ADHD diagnosis and on medication usage, dosage, time of day administered and whether the medication(s) had been taken on the day of dental treatment.¹⁶

The American Academy of Pediatric Dentistry includes patients diagnosed with ADHD under the category "special health care needs", defined as "any physical, developmental, mental, sensory, behavioral, cognitive, or emotional impairment or limiting condition that requires medical management, health care intervention, and/or use of specialized services or programs. The condition may be congenital, developmental, or acquired through disease, trauma, or environmental cause and may impose limitations in performing daily self-maintenance activities or substantial limitations in a major life activity".¹⁷

There are no clear guidelines for managing these types of patients, especially those taking methylphenidate (Ritalin) or other medications that are commonly prescribed on a daily basis for managing the symptoms of ADHD. Since the prescription of these medications is so widespread, it is essential for the medical/dental caregiver to be familiar with their actions and pharmacodynamics in order to choose the best approaches for managing these patients.¹⁷

To date, there are no in-depth retrospective or prospective research studies on the effect of ADHD on dental treatment.

The aims of the present study were to evaluate:

1. The prevalence of ADHD patients treated by pediatric dentists and general practitioners in Israel
2. The general knowledge of pediatric dentists in understanding the special needs associated with dental treatments for children with ADHD
3. The behavior management techniques used by Israeli dentists and their relative effectiveness
4. The recognition of the side effects of ADHD medications as they affect dental treatment of pediatric patients with ADHD

METHODS AND MATERIAL

Ethical approval to conduct this study was obtained from the Human Research Ethics Committee of Tel Aviv University, Israel. A multiple-choice questionnaire was handed out to 160 dentists who treat pediatric patients, including specialists in pediatric dentistry, pediatric dental residents and general practitioners. The form was distributed and collected during the annual conference of the Israel Society of Dentistry for

Children that was held in December 2016. It was composed of 29 questions divided into two sub-sections. The first section included 10 questions on the responder's demographics: gender, age, when and where they finished their degree, and whether they had a specialty degree in pediatric dentistry. In addition, they were asked to indicate whether they worked in public or private clinics. The second section queried the practitioners on their experience in treating patients with ADHD, familiarity with medications used to treat ADHD and their side effects, the behavioral management techniques the practitioner utilized to treat these patients, and their records on history of traumatic injuries to these patients. In addition, the questionnaire included items on specific measures that the dentists had taken during past experiences of treating these patients, and whether they felt that they had sufficient knowledge in effectively managing them. The questions were either single-answer multiple choice or scored on a Likert-type scale from 1 to 5.

To be more specific, some of the questions we asked was phrased as followed: 'have u ever treated a patient with ADHD?' 'Have u noticed a rise in patients diagnosed with ADHD during the past 5 years?' 'What is the percentage of your patients diagnosed with ADHD?' 'Are u familiar with the drugs Ritalin/Attent/Adderall/Concerta?' , 'Rank ADHD drugs side effects and behavior patterns of ADHD patients according to their prevalence from 1 to 5', 'what are the behavior managements tools that u used to treat these patients', and 'are they sufficiently effective?' 'Rank your degree of anxiety of treating these patients from 1 to 5', 'do u feel u lack the sufficient knowledge in dealing with ADHD patients?'

Statistical analysis

The statistical analysis consisted of descriptive statistics and inference testing using the t-test, chi-square tests, Fisher's exact test and the Mann-Whitney U-test using SPSS. Significance was set at a P value < 0.05.

RESULTS

Of the 160 dentists who attended the conference, 96 completed the survey, yielding a 60% response rate. The average age of the participants ranged between 25 to 70 years (mean 41 years), 70 were females and 26 were males. Forty-five (57.4%) had graduated from dental school more than 10 years earlier and only 17 (18%) graduated during the past 5 years (figure 1). One half (n= 46, 51%) were pediatric dental specialists and the remaining 50 (49%) were general dental practitioners. Seventy-six of the responders (79%) indicated that they work at private clinics, and 65 (67.7%) at public dental clinics. Specialists and male dentists tended to work solely in private clinics rather than public clinics (44 [95.7%] and 24 [92.3%], respectively).

Dental aspects of pediatric ADHD patients

Almost all responding practitioners (n = 92, 96%) reported treating patients diagnosed with ADHD and most of them (n = 80, 83.9%) noted a rise in ADHD patients during the past 5 years. The specialists estimated that there was a higher percentage of

ADHD patients in their practice compared to the non-specialists (figure 2). Both groups of dentists estimated that the percentage of children with ADHD in the overall patient population was growing. The medications Ritalin and Concerta were known by all the responders (n = 96, 98.9%), and Attent and Aderall were less well known (n = 23, 23.7% and n = 55, 57.4%, respectively). The specialists were more familiar with the drug "Aderall" than the rest of the participants (figure 3).

Figure 1: Year of graduation from dental school among participants.

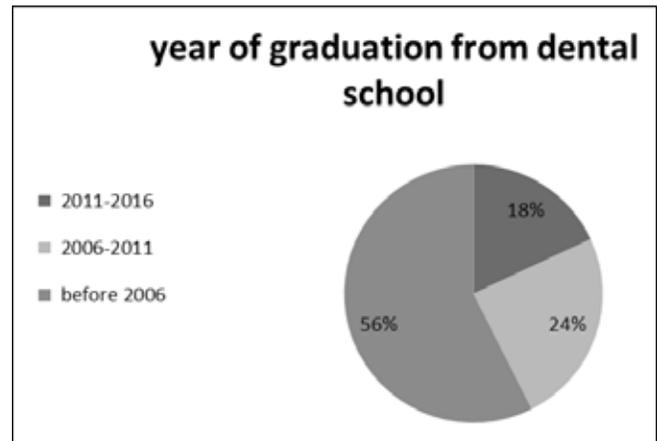


Figure 2: Percentage of ADHD Patients as Estimated by the Participants. (when participants were asked "what is your estimation of the percentage of your patients with ADHD ?")

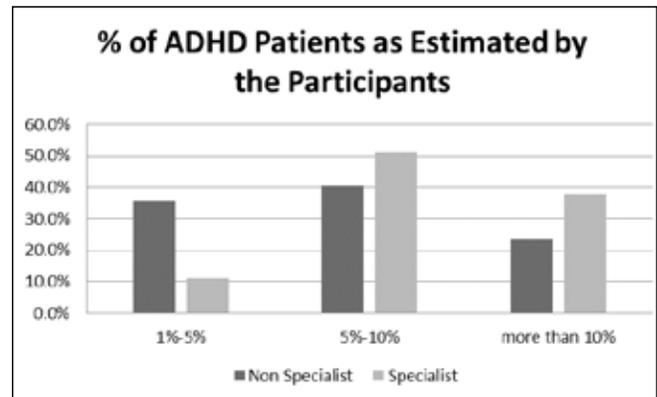
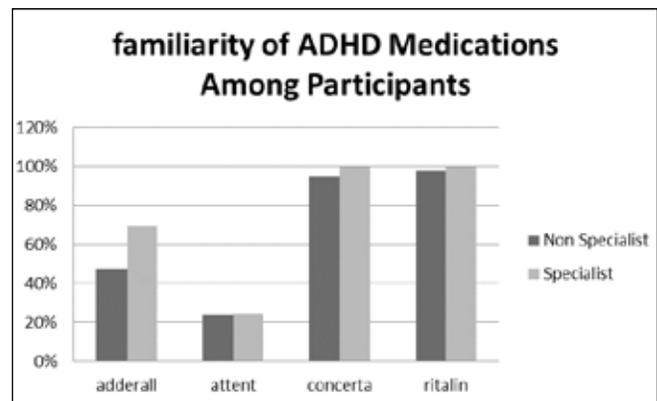


Figure 3: Familiarity of ADHD medications among the survey participants.



Side effects of ADHD medications

Most of the responders (n = 88, 91%) rated the side effect “loss of appetite” as the most common one among patients taking medications to manage ADHD symptoms, while “headache” and “stomach ache” were rated the lowest (n = 3, 3% and n = 2, 2%, respectively). Specialists rated the side effect “loss of appetite” as having a higher prevalence compared to the others responders (table 1).

Table 1: Prevalence of side effects of ADHD medications as estimated by the participants

Side effect	Participant	Responders, n	Mean	Std. Deviation
Loss of appetite	Non-specialist	44	3.61	1.224
	Specialist	42	4.40	1.014
Xerostomia	Non-specialist	44	3.14	1.173
	Specialist	36	2.92	1.251
Headache	Non-specialist	43	2.23	1.172
	Specialist	35	2.63	1.165
Stomach-ache	Non-specialist	44	2.23	1.138
	Specialist	35	2.57	1.092
Nausea	Non-specialist	44	2.11	1.017
	Specialist	35	2.20	0.868
Taste changes	Non-specialist	44	2.16	1.140
	Specialist	37	2.14	1.228

Behavior management techniques for ADHD children

Most responders rated some behavior patterns that are common in ADHD patients with a grade of 4 in a scale from 1 to 5: they were “dental anxiety”, “lack of attention to specific instructions given by the dentist”, “impulsiveness”, “sensitivity to noise”, “mouth sensitivity”, “motor restlessness and lack of patience”. General practitioners rated the behavior patterns “lack of attention to instructions” and “lack of patience” as more prominent side effects than all the other choices compared to the pediatric dental specialists. The majority of responders claimed that they use inhalational sedation with nitrous oxide in order to treat ADHD patients: the female practitioners reported using this management technique more often than the males (n = 49 [71.1%] and n=13 [50%], respectively). Nevertheless, 88.8% (n = 85) of all the responders noted that management by inhalational sedation with nitrous oxide is not effective and they indicated that they needed additional tools to obtain a good level of cooperation during dental treatment.

Knowledge of traumatic injuries in the ADHD child's past

When asked about their impression of whether or not there was a history of traumatic dental injuries among their ADHD patients, most dentists estimated that 1-5% of them had experienced traumatic injuries that mostly occurred during school/kindergarten activities (52.3%). Female dentists estimated that a higher percentage of their ADHD patients were referred to them as a result of a traumatic injury compared to male dentists (n = 27 [38.1%] and n = 4 [16%], respectively).

Dental management of pediatric ADHD patients

Eighty-seven (91.1%) of the practitioners responded that they ask their ADHD patients to take the usual doses of any drug taken regularly to treat ADHD symptoms, regardless of the planned dental procedure and the intention to use sedation. Moreover, 41 (43%) of the responding dentists believed that these patients react differently to sedative drugs compared with other patients. When asked “Do you think you lack knowledge in managing ADHD patients?”, there was a statistically significant difference between pediatric dental specialists and general practitioners: only 8 specialists (18.2%) thought that they did compared to 28 general practitioners (55.8%) (P < 0.05).

DISCUSSION

Our primary intention in performing this survey was to determine what dentists considered as being the prevalence of ADHD patients encountered in their practice and to obtain an overview of their general knowledge in treating pediatric patients diagnosed with ADHD. The results of this questionnaire survey revealed that all the responders had encountered at least one ADHD patient during their dental practice. The recently published rate of children diagnosed with ADHD in Israel is 7.2%, which is twice the world average.¹⁸ Cohen *et al*¹⁹ reported a 12.6% prevalence of ADHD among Israeli children aged 6 to 13 years: 6.8% of children were diagnosed with ADHD in 2005 compared to 14.4% in 2014 (meaning one in every seven children). There are no clear guidelines for the dental treatment of these children. This survey explored how Israeli dentists dealt with pharmacologic and behavior management issues associated with this special pediatric population.

Medications for ADHD treatment are mainly stimulants that affect the central nervous system. It could theoretically be expected, therefore, that these patients would react differently to sedative medications, such as benzodiazepines, which are usually given to uncooperative dental patients. According to our results, almost all of the practitioners (n = 87, 91.1%) stated that they ask their ADHD patients to take the usual doses of their usual drugs for treating ADHD symptoms, regardless whether or not they intended to use sedative drugs. No side effects associated with possible drug interactions were reported by the responders of our study. Nevertheless, it is known that medications used to treat ADHD can cause adverse interactions with drugs used in dentistry. Methylphenidate, amphetamine and dextroamphetamine are drugs commonly prescribed to ADHD patients, and they are associated with elevations in blood pressure and heart rate.^{20, 21} Prudent care includes scheduling these patients for early morning appointments, requesting that they delay their morning doses of medication until after the dental appointment and, as clinically necessary, taking and recording the patient's preoperative vital signs and intraoperative values. Local anesthesia sufficient to limit pain and the endogenous production of catecholamines that might interact with these agents is mandatory.²² Moreover, an aspirating syringe must be used to avoid intravascular injection and the possibility

of a summation of drug effects from vasoconstrictor agents (epinephrine) used in local anesthesia.²³

In general, both the pediatric dentists and the general practitioners reported being familiar with the more common medications used to treat ADHD. The results showed that drugs not used as a first-line treatment, such as Aderall and Attent, were less familiar to general practitioners compared to pediatric dental specialists. The pediatric dentists also estimated that their practice included a higher percentage of patients with ADHD. We assume that the differences between the specialists and non-specialists may be at least partially due to the complexity of treating these patients that leads to more referrals to the specialists.

At present there are no guidelines that clearly specify the effectiveness of different treatment modalities, especially when combining stimulant medications used for the treatment of ADHD and the sedative drugs used by dentists. In a survey similar to ours that was performed in 2007 by Kerins *et al*⁵, the dentists stated that they used a variety of pharmacologic behavior management techniques when treating ADHD patients, with varied levels of effectiveness. Those authors' findings support the creation of guidelines to better enable dentists to pharmacologically manage ADHD patients.⁵

One of this study's limitation is the relatively small number of participants, whereupon the findings may not reflect the overall national picture.

We believe that the dental treatment for children with ADHD would be considerably enhanced by an understanding of their behavior management needs. The practitioner should also have a working knowledge of the medications prescribed to these children, as well as the side effects and possible drug interactions with the sedatives included in the dental protocol.

CONCLUSIONS

1. All responding pediatric dentists reported treating patients with ADHD.
2. Pediatric dentists reported using a variety of pharmacologic and behavior management techniques when treating ADHD patients, with varied degrees of effectiveness.
3. Pediatric dental specialists estimated that they treated a higher percentage of ADHD patients and were more familiar with the various drugs used to treat ADHD compared to non-specialists.
4. Specific guidelines for the most effective and safest use of medications as well as effective behavior management techniques are needed for the provision of optimal dental care to children with ADHD.

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