

## Behavior and orofacial characteristics of children with attention-deficit hyperactivity disorder during a dental visit

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*ADHD is a neuropsychological disorder, affecting attention, impulsiveness and activeness. The study included 36 children with ADHD, 47 without, and two silent observers. A dental form, SNAP-IV and ADHDT symptom checklists were used. Statistically significant differences were observed in hospitalization histories, oral habits, tongue characteristics, and facial biotype. Differences in orofacial characteristics and behavior between the groups were confirmed.*

J Clin Pediatr Dent 30(3): 183–190, 2006

### INTRODUCTION

**A**DHD (Attention Deficit Hyperactivity Disorder) refers to a neuropsychological developmental disorder that affects periods of attention, impulse control and activity levels in children.<sup>1,2</sup> It is the most common neuropsychiatric disorder in children,<sup>3</sup> affecting approximately 3 to 5% of the population,<sup>4</sup> from all socioeconomic and cultural levels. Boys are more prone to such a disorder than girls, in a ratio that varies from 3:1 to 9:1.<sup>5</sup>

According to the DSM-IV<sup>6</sup> (Diagnostic and Statistical Manual of Mental Disorders - fourth edition), deficiencies in attention may be seen if the child presents six or more of the following symptoms: 1) often fails to pay close attention to details, or makes careless mistakes in schoolwork or other activities; 2) often has difficulty sustaining attention in tasks or play activities;

3) often does not seem to listen when spoken to directly; 4) often does not follow through on instructions and fails to finish schoolwork, chores or duties in the workplace; 5) often has difficulty organizing tasks and activities; 6) often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (e.g. schoolwork or homework); 7) often loses things necessary for tasks or activities (e.g. toys, school assignments, pencils, books or tools); 8) often is easily distracted by external stimuli; 9) often is forgetful in daily activities. Hyperactive disorder and impulsiveness may be seen in the child who presents six or more of the following symptoms: 1) often fidgets with hands or feet, or squirms in seat; 2) often leaves seat in situations in which to remain seated is expected; 3) often runs about or climbs excessively in inappropriate situations; 4) often has difficulty playing or engaging in leisure activities quietly; 5) often is “on the go” or acts as if “driven by a motor”; 6) often talks excessively; blurts out answers before questions have been completed; 7) often has difficulty awaiting for his turn 8) often interrupts 9) often intrudes on others (e.g. butts into conversations/games).

In order to make a valid diagnosis, these symptoms must be present for at least six months before age seven to a degree that is inconsistent with the developmental level of the child, and cause impairments in at least two different settings. Thus, there must be clear evidence of clinically significant impairment in social, academic, or occupational functioning. These combined symptoms, which may eventually constitute a syndrome, must not be a temporary reaction to a stressful event and must

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be present for several years.<sup>4</sup> In addition, the symptoms must not occur exclusively during the course of a pervasive developmental disorder, schizophrenia, or any other psychotic or other mental disorder.<sup>6</sup> The diagnostic criteria of the ICD-10 (International Classification of Diseases) establishes that at least six symptoms in the area of inattention, three in the area of hyperactivity, and at least one in the area of impulsivity must be present in order to make a diagnosis.<sup>7</sup> Even though most of the children with ADHD show symptoms of inattention and hyperactivity-impulsivity, some of them portray a combination of symptoms which predominate. For this reason, three subtypes are permitted: Combined, predominantly inattentive, and predominantly hyperactive-impulsive.<sup>2,4,6</sup>

Concerning the etiology, many possible causes have been studied, including biological and social conditions, injuries to the central nervous system (infection, toxic agents, prolonged hypoxia)<sup>8</sup> and the possibility of genetic factors being involved.<sup>2,4,9</sup> Studies have indicated that ADHD might be caused by interacting genes, such as the gene for the b-receptor of the thyroid hormone (GRTH), the dopamine transporter gene (DAT) and the dopamine D4 receptor gene (DRD4).<sup>9</sup> Other authors maintain that children with ADHD usually come from dysfunctional families and have a parent with the same psychopathology.<sup>10</sup> Comorbid conditions have been reported including oppositional/defiant disorder, conduct disorder,<sup>11</sup> anxiety disorder, Tourette's syndrome, obsessive-compulsive disorder, and learning disabilities.<sup>12</sup> Studies report that ADHD affects nearly 40% of the children with dyslexia.<sup>13</sup>

Many authors agree that the accepted approach to treatment involves multimodal intervention combining pharmacological and psychological treatments with a supportive management strategy, in order to control the symptoms of ADHD and improve social and academic functioning.<sup>2</sup> However, clear and definite results have not proven the efficacy of these therapies when used either alone or in combination.<sup>14</sup> Other authors mention the importance of the child's diet, even though more studies are needed to confirm the scientific principles proposed.<sup>8,15</sup>

This syndrome has been widely studied in neurology, psychiatry, psychology, and psycho pedagogy. But it has not been studied as fully in dentistry. There are gaps with regard to the behavioral management of these children and to the possible existence of certain orofacial characteristics. Some of the characteristics noted previously include enlarged head circumference, epicanthic folds, hypertelorism and abnormal position or configuration of the ears. Studies have also noted a longer lower face, more pointed chin, shorter upper lip, and wider mouth. Among the anomalies of the oral cavity are a steep palatal vault, fissured tongue, geographic tongue, aberrant frenula and irregular, crowded, or malformed teeth, a wide neonatal line and very porous

prenatal enamel in the primary teeth in some of these children.<sup>17</sup> Minor physical anomalies of the orofacial region have been reported but prevalence rates have not been determined.

The behavioral characteristics of children with ADHD can determine the success or failure of a dental appointment. The difficulty in gaining their attention and the requirement that they must be seated and control their activities for at least 30 minutes<sup>17</sup> are common problems. The pediatric dentist must be aware of the situation and recognize the problem easily in order to establish a stable environment. He can then use an appropriate treatment plan that minimizes or stabilizes the symptoms instead of aggravating them.

It has been recommended that scheduling dental appointments during the morning when children are least fatigued, most attentive, and best able to remain seated in the dental chair will improve behavior management. In addition, it has been suggested that colorful and highly stimulating educational materials should be employed and instructions simplified and repeated numerous times with the dentist always maintaining eye contact with the child.<sup>17</sup>

## METHODS

An analytical observational study design was used for this study. It consisted of a sample of 36 children with ADHD sent from the Psychiatric Department of the Military Hospital of Bogotá, and 47 children not diagnosed with the ADHD, who attended the dental clinics at the Pontificia Universidad Javeriana in Bogotá, Colombia. Children between 5 and 13 years of age from all socio-economic levels were included. Patients with systemic diseases and other neuropsychological problems were excluded.

Two dentists, previously trained for the study, participated in this research either as silent observer or dentist, alternating roles every other day and performing one function at a time. The observer evaluated the behavior shown by the patient during the dental appointment using a special evaluation form. The dentist was responsible for the oral procedures and the behavior management of the children as well as interacting with the parents. Neither the observer nor the dentist knew if the child had been diagnosed with ADHD. A third person made patient selection at random. The parents were asked not to give the child any medication the day of the appointment, even though he or she was undergoing pharmacological treatment.

The forms used to collect data consisted of a medical/dental record and two psychological tests designed especially to evaluate the presence of ADHD. The tests, which were supported by the DSM-IV consisted of the SNAP-IV, a revision of the Swanson, Nolan and Pelham Questionnaire and the Attention Deficit Hyperactivity Disorder Test or ADHDT, slightly modified for use in the dental visit (Forms 1 and 2).

Form 1.

1. SNAP IV Rating Scale Questions

Name: \_\_\_\_\_ Gender: \_\_\_\_\_ Age: \_\_\_\_\_ Grade: \_\_\_\_\_ Date: \_\_\_\_\_

Completed by: \_\_\_\_\_ Relationship: \_\_\_\_\_

For each item, select the box that best describes this child. Put only one check per item.	Not at all (0)	Just a Little (1)	Quite A Bit (2)	Very Much (3)
1. Often fails to give close attention to details or makes careless mistakes in schoolwork, work, or other activities				
2. Often has difficulty sustaining attention in tasks or play activities				
3. Often does not seem to listen when spoken to directly				
4. Often does not follow through on instructions and fails to finish schoolwork, chores, or duties				
5. Often has difficulty organizing tasks and activities				
6. Often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (e.g., schoolwork or homework)				
7. Often loses things necessary for tasks or activities (e.g., toys, school assignments, pencils, books, or tools)				
8. Often is distracted by external stimuli				
9. Often is forgetful in daily activities				
10. Often fidgets with hands or feet or squirms in seat				
11. Often leaves seat in classroom or in other situations in which remaining seated is expected				
12. Often runs about or climbs excessively in situations in which it is inappropriate				
13. Often has difficulty playing or engaging in leisure activities quietly				
14. Often is "on the go" or often acts as if "driven by a motor"				
15. Often talks excessively				
16. Often blurts out answers before questions have been completed				
17. Often has difficulty awaiting turn				
18. Often interrupts or intrudes on others (e.g., butts into conversations/games)				
	Sum of Items for Each Scale	Average Rating For Item for	Teacher 5% Cutoff	Parent 5% Cutoff
Average score for ADHD-Inattention (sum of items 1-9/ # of items)		_____	2.56	1.78
Average score for ADHD-Hyperactivity-Impulsivity (sum of items 10-18/ # of items)		_____	1.78	1.44
Average score for ADHD-Combined (sum of items 1-18/ # of items)		_____	2.00	1.67

The 4-point response is scored 0-3 (Not at All=0, Just a Little=1, Quite a Bit=2, and Very Much=3). Subscale scores on the SNAP-IV are calculated by summing the scores on the items in the specific subset (e.g., Inattention) and dividing by the number of items in the subset (e.g., 9). The score for any subset is expressed as the Average Rating Per Item. The 5% cutoff scores for teachers and parents are provided. Compare the Average Rating Per Item score to the cut-off score to determine if the score falls within the top 5%. Scores in the top 5% are considered significant. From SNAP-IV Teacher and Parent Rating Scale by James Swanson, UCI, Irvine, CA. Printed with permission. All rights reserved.

Form 2.

**2. ADHDT\* Response Form**

DIRECTIONS: Please indicate which of the following behaviors/characteristics are a problem for this individual (depending of the moment of the dental visit). Mark or circle 0 if the behavior is *not a problem* (the subject rarely demonstrates this problem, and it does not impair his or her functioning) or if you have not had the opportunity to observe the behavior. Mark or circle 1 if the item refers to a behavior that is a *mild* problem (the subject sometimes demonstrates this behavior, and occasionally causes problems and impairs his or her functioning). Mark or circle 2 if the item refers to a behavior that is a *severe* problem for this individual (the subject frequently demonstrates this behavior, and it usually causes problems and impairs his or her functioning). Do not skip any items.

Greetings and anamnesis	Not a Problem	Mild Problem	Severe Problem
1. Loud	0	1	2
2. Constantly "on-the-go"	0	1	2
3. Excessive running, jumping, climbing	0	1	2
4. Inability to play quietly	0	1	2
5. Shifts from one activity to the next	0	1	2
6. Fails to wait for one's turn	0	1	2
7. Difficulty waiting turn	0	1	2
8. Blurts out answers	0	1	2
9. Interrupts conversations	0	1	2
10. Intrudes on others	0	1	2
Clinical Exam	Not a Problem	Mild Problem	Severe Problem
11. Twisting and wiggling in seat	0	1	2
12. Grabs objects	0	1	2
13. Excessive talking	0	1	2
14. Difficulty remaining seated	0	1	2
15. Constantly manipulating objects	0	1	2
16. Fidgets	0	1	2
17. Impulsive	0	1	2
Tooth brushing instructions	Not a Problem	Mild Problem	Severe Problem
18. Acts before thinking	0	1	2
19. Does not wait for directions	0	1	2
20. Fails to follow rules of games	0	1	2
21. Poor concentration	0	1	2
22. Fails to finish projects	0	1	2
23. Disorganized	0	1	2
24. Poor planning ability	0	1	2
25. Absentminded	0	1	2
26. Inattentive	0	1	2
27. Difficulty following directions	0	1	2
28. Short attention span	0	1	2
29. Easily distracted	0	1	2
30. Difficulty sustaining attention	0	1	2
31. Difficulty staying on task	0	1	2
32. Difficulty completing tasks	0	1	2
Dental Prophylaxis and Application of Fluoride	Not a Problem	Mild Problem	Severe Problem
33. Easily excited	0	1	2
34. Restless	0	1	2
35. Squirms	0	1	2
Saying good by	Not a Problem	Mild Problem	Severe Problem
36. Frequently loses things	0	1	2

\* From ADHDT. A Method for Identifying Individuals with ADHD. Response Form (#6882) from PRO-ED 8700 Shoal Creek Blvd., Austin, TX 78757, 512/451-3246

\*\*Modified for the purpose of this work

The intended procedures were explained to the parents or guardians of the children and asked to sign the consent form if in agreement before inclusion in the study. After the initial greeting, the child was given the choice of playing with either a 250 piece puzzle or two coloring books with colored pencils. Meanwhile, the dentist interviewed the parent in the waiting room. The observer noted the child's behavior from the initial greeting until the end of the appointment, guided by items enumerated in the ADHDT test adapted to the dental visit.

Once the interview was concluded, the children and parents were invited to go into the dental area. While the parent was told to remain silent and to complete the SNAP-IV test, the child was seated in the dental chair and the dentist began the clinical exam, including soft and hard tissues, including dental anomalies, and craniofacial characteristics, and a dental prophylaxis. Next, the child was presented with a toothbrush and asked to use it, standing in front of a hand mirror held by the dentist. The child was either commended on his technique or shown how he or she might improve it. Finally, the dentist applied a topical fluoride gel and explained the oral results to the parent.

For the statistical analysis, the program SPSS version 11.0 was used. A descriptive analysis of the qualitative variables was done using frequency tables and percentages, and for the analysis of the quantitative variables, averages and their corresponding standard deviations were measured. For the association analysis, the risk relation was evaluated using the odds ratio (95% confidence interval) and Chi square ( $p \leq 0.05$ ). For the difference analysis, the U of Mann-Whitney test ( $p \leq 0.05$ ) and t Student technique were used. And finally, for the psychometric analysis, the Crombach's coefficient alpha was used in order to evaluate the internal consistency of the items on the ADHDT and the SNAP-IV.

## RESULTS

The ADHD group sample consisted of 30 males (83.3%) and 6 females (16.7%), while the control group contained 31 male (66%) and 16 female patients (34%).

According to the risk estimation between the presence of ADHD and sex as a risk factor, no statistically significant value was obtained in the present study. In total, 73.5% corresponded to the male gender (61 patients) and 26.5% to the female (22 patients). In relation to the mean age, an average of 9.05 years was obtained with a minimum of 5 years of age and a maximum of 13, corresponding to the stipulated ages in the inclusion criteria of this work.

No statistically significant differences were found regarding the presence of ADHD with relation to the gyno-obstetric (natural childbirth or caesarean), traumatic and pathological history, even though the control group presented a lower percentage of trauma and pathologies. In relation to the hospitalization history, a

statistically significant association was found between the previous history of hospitalization and the presence of ADHD ( $p = 0.02$ ), with a higher frequency of 62.2% in this group, compared to only 37.8% in the control group.

When analyzing the psychosocial records, no statistically significant differences were found in either group with relation to the number of siblings and the domestic situation of the child. However, it was found that in the ADHD group there were a larger proportion of functional families (59.5%) compared to 47.8% of the control group. A statistically significant association between socioeconomic levels and the studied groups ( $p = 0.009$ ) was evident with the control group having an important percentage in level number 2 (50%) while the ADHD group had its highest percentage in level number 3 (62.2%).

A statistically significant association ( $p = 0.004$ ) was found with a higher prevalence of oral habits in the ADHD group when compared with the control group. In 37.8% of the children with ADHD a higher frequency of nail-biting existed when compared with only 10.9% in the control group. The ADHD group showed a 10.8% frequency of lip biting as compared with 2.2% in the control group. Bruxism, was found in only 5.4% of the ADHD group.

There were no statistically significant differences between the two groups with the lips, frenula, mucosa, palate and oropharynx. However, regarding the tongue, statistically significant differences were found ( $p = 0.032$ ), with a higher percentage of normality in the control group. In the ADHD group, 56.8% showed signs of a saburral tongue, followed by 18.9% with a fissured tongue, compared to the control group where 7% and 4.3% were found respectively.

When analyzing the DMFT and the deft index, an average of 6.78 teeth was found in the ADHD group and 9.98 teeth in the control group, a statistically significant difference ( $p = 0.036$ ), suggesting a minor level of dental disease in the ADHD group. No statistically significant differences were found between both groups when the physiological attrition facets were analyzed. Nevertheless, with regard to the pathological attrition facets, statistically significant differences were found ( $p = 0.031$ ). The ADHD group presented an average of 1.3 facets (0-9 affected teeth), in contrast with the control group with 0.51 facets (0-5 affected teeth). No statistically significant differences were observed in relation to number, size or shape when the development alterations were analyzed. A higher percentage of hypomineralization was seen in the ADHD group (5.4 teeth) in contrast to the control group (3.6 teeth), a statistically significant difference ( $p = 0.05$ ).

Statistically significant differences were found in relation to facial form ( $p = 0.029$ ). A mainly mesoprosopic population stands out in the control group (73.9%) in contrast to only 45.9% in the ADHD group, which in turn presents a larger proportion of other

facial biotypes, especially euriprosopic (32.4%) and leptoprosopic (21.6%). These statistics contrast with 21.7% and 16.9% respectively in the control group. No statistically significant differences were found for the lower third of the face. Statistically significant differences were found in the middle third ( $p=0.035$ ), in 13.5% of the ADHD group. Statistically significant differences ( $p=0.014$ ) in the upper third of the face were also found to be 21.6% in the ADHD group and 4.3% in the control group. No statistically significant differences were found in the other craniofacial characteristics, including profile, overbite and overjet.

No statistically significant differences were found between the two groups with respect to left and right molar relation, and right canine relation. However, regarding the left canine relation, statistically significant differences were found ( $p=0.31$ ). An 80% predominance of a class I molar relationship was found in the ADHD group in contrast with 53.7% in the control group. With relation to the other malocclusions, a percentage of 11.4% and 8.6% were seen for classes II and III in the ADHD group and 14.6% and 31.7% for classes II and III in the control group.

**Behavioral assessment:** According to an analysis of the behavioral characteristics of ADHD as manifested by the subjects, using ADHDT's parameters, patients were "disorganized," with a mean of 0.77 and "frequently loses things," with a mean of 0.76. However, neither feature was significant (score below 1). The

mean of the ADHD quotients was 71.24, indicating a low probability of ADHD in the general population. One high score of 111 resulted, indicative of the presence of ADHD, as well as a quotient of 55, showing no ADHD. In concordance with the ADHDT scores, the percentages obtained were mostly below the mean quotient indicating probability of ADHD, with 53% scoring "very low," 19.3% "low," 13.3% "below average," 13.3% "average," and only 1.2% in the category "above average."

The following percentages indicating the probability of ADHD for each of the ADHDT subsets were obtained: **hyperactivity:** 39.8% were "low", 31.3% "below average", 20.5% "average" and 8.4% "very low"; **impulsivity:** 49.4% were "low," 31.3% "below average," and 19.3% "average"; **inattention:** 51.8% were "very low," 19.3% "average," 15.7% "low," 9.6% "low average," and 3.6% "above average."

A relatively normal pattern emerged from the hyperactivity-impulsivity data of the SNAP-IV test provided by the parents or guardians. Statistics indicated a mean of 29.5 +/- 11.2 for the ADHD group and a mean of 13.1 +/- 9.4 for the control group (Table 1). With regard to the data for inattention, the difference between the two groups was more evident, with a mean of 15.03 +/- 5.78 in the ADHD group in comparison to 6.15 +/- 5.5 in the control one (Table 2).

A significant difference was observed from the ADHDT scores with respect to the probability of

Table 1. Hyperactivity probability

			GROUP ADHD	GROUP CONTROL	Total
HYPERACTIVITY PROBABILITY	VERY LOW	NUMBER OF PATIENTS % OF THE GROUP	1 2.8%	6 12.8%	7 8.4%
	LOW	NUMBER OF PATIENTS % OF THE GROUP	6 16.7%	27 57.4%	33 39.8%
	BELOW AVERAGE	NUMBER OF PATIENTS % OF THE GROUP	15 41.7%	11 23.4%	26 31.3%
	AVERAGE	NUMBER OF PATIENTS % OF THE GROUP	14 38.9%	3 6.4%	17 20.5%
TOTAL		NUMBER OF PATIENTS % OF THE GROUP	36 100%	47 100%	83 100

Table 2. Inattention probability

			GROUP ADHD	GROUP CONTROL	Total
INATTENTION PROBABILITY	VERY LOW	NUMBER OF PATIENTS % OF THE GROUP	10 27.8%	33 70.2%	43 51.8%
	LOW	NUMBER OF PATIENTS % OF THE GROUP	6 16.7%	7 14.9%	13 15.7%
	BELOW AVERAGE	NUMBER OF PATIENTS % OF THE GROUP	7 19.4%	1 2.1%	8 9.6%
	AVERAGE	NUMBER OF PATIENTS % OF THE GROUP	10 27.8%	6 12.8%	16 19.3%
	ABOVE AVERAGE	NUMBER OF PATIENTS % OF THE GROUP	3 8.3%		3 3.6%
TOTAL		NUMBER OF PATIENTS % OF THE GROUP	36 100%	47 100%	83 100

Table 3: ADHD probability

		SNAP IV RESULTS				
			LOW	MEDIUM	HIGH	TOTAL
ADHD PROBABILITY	VERY LOW	NUMBER OF PATIENTS	30	11	3	44
		ADHD PROBABILITY	68.2%	25.0%	6.8%	100%
		SNAP IV RESULTS*	75.0%	39.3%	20.0%	53.0%
ADHD PROBABILITY	LOW	NUMBER OF PATIENTS	7	6	3	16
		ADHD PROBABILITY	43.8%	37.5%	18.8%	100%
		SNAP IV RESULTS*	17.5%	21.4%	20.0%	19.3%
ADHD PROBABILITY	BELOW AVERAGE	NUMBER OF PATIENTS	2	5	4	11
		ADHD PROBABILITY	18.2%	45.5%	36.4%	100%
		SNAP IV RESULTS*	5.0%	17.9%	26.7%	13.3%
ADHD PROBABILITY	AVERAGE	NUMBER OF PATIENTS	1	6	4	11
		ADHD PROBABILITY	9.1%	54.5%	36.4%	100%
		SNAP IV RESULTS*	2.5%	21.4%	26.7%	13.3%
ADHD PROBABILITY	ABOVE AVERAGE	NUMBER OF PATIENTS			1	1
		ADHD PROBABILITY			100%	100%
		SNAP IV RESULTS*			6.7%	1.2%
TOTAL		NUMBER OF PATIENTS	40	28	15	83
		ADHD PROBABILITY	48.2%	33.7%	18.1%	100%
		SNAP IV RESULTS*	100%	100%	100%	100%

ADHD in the two groups. This was clearly observed in the decreasing percentage of the control cases in which the probability of ADHD increased, in contrast to the more erratic distribution observed in the ADHD group (Table 3).

Reviewing the mean scores for ADHD as a whole and for each of the ADHD subsets, the ADHD group scored significantly higher than the control group ( $p < 0.001$ ). The hyperactivity subset had the highest score with a mean of 7.28 +/- 2.3 for the ADHD group in contrast to 4.74 +/- 1.5 for the control group. An important 38.9% of the ADHD cases indicated an "average" probability as opposed to 6.4% of the control group who demonstrated "low" probability, a statistically significant difference between the two groups.

Similarly, in the inattention subset, there was a statistically significant difference ( $p = 0.001$ ) between the two groups: 70.2% of the control group presented "very low" probability and 0% in "above average" probability, in contrast to 27.8% of the ADHD group which had "very low" probability and 8.3% "above average."

Using the SNAP-IV analysis, the ADHD group showed a tendency of higher probabilities by scoring 38.9% with high probability and 19.4% with low probability in comparison to the control group which showed lower probabilities of having ADHD by scoring 2.1% with high probability, and 70.2% with a low probability.

The scores recorded using SNAP-IV exceeded those of the ADHDT with respect to ADHD probability. This can be appreciated in the high 36.4% of cases with an above average probability in SNAP-IV as opposed to the absence of equivalent scores in cases observed in ADHDT. Nevertheless, despite significant differences ( $p = 0.002$ ) between the examiner (ADHDT) and the guardian perspective (SNAP-IV), a strong correlation

exists between the two tests ( $p < 0.5$ ) in this study.

A study of the psychometric analysis of the SNAP-IV and the ADHDT and its correlation revealed a good association between them with regard to ADHD probability. SNAP-IV scores were more variable due to the greater number of subjects included in the high category whereas the ADHDT scores fell in the above average category. Generally speaking, a medium correlation was found between the ADHDT and the SNAP-IV ( $r = 0.505$ ). However, the Cronbach's coefficient alphas were 0.9457 for the ADHDT and 0.953 for the SNAP-IV.

## DISCUSSION

The higher proportion of male to female is standard for the ADHD recorded characteristics in which males are estimated to outnumber females in a proportion that varies from 3:1 to 9:1.

The significant correlation found between the hospitalization experience and the diagnosis of ADHD could be explained by the fact that children with ADHD are more prone to suffer episodes of trauma and illness as has been reported in previous studies. Discrepancies regarding socioeconomic status and its relation to the presence of ADHD could be attributed to the sample source of this study, since the patients that attend the University's clinics pertain primarily to the low socioeconomic classes as opposed to a more heterogeneous community that relies on the Military Hospital clinics.

Oral habits such as nail biting, bruxism and frequent biting of different objects and their significant association with the presence of ADHD could be explained as an expression of a high level of anxiety displayed by these children in a controlled environment. The correlation of the oral characteristics with the ADHD,

specifically saburral and fissured tongue and steep palatal vault, corresponds with previously published data.

The higher DMFT or deft score affecting the control group could be explained by the sample source, because the control group may have reduced accessibility to the health services compared to the ADHD group. The higher incidence of pathological attrition facets found in the ADHD group could be explained by more pronounced masticatory activity and a higher incidence of parafunctional habits as a means of liberating stress or anxiety which are common consequences of ADHD. The higher occurrence of enamel opacities found in the ADHD group could be ascribed to the embryonic origin of its structure just as the ectoderm of the central nervous system can suffer injury at the same time of development.

**Behavioral assessment:** It is noteworthy that children who got the higher scores both with the SNAP-IV and the ADHDT were also the more difficult ones in terms of behavioral management in the dental office. This observation differs from that reported by Felicetti and Juliard<sup>19</sup> who did not find statistically significant differences between the behavior of children with and without ADHD in a routine dental appointment. A relevant feature in this study was the inattention reflected in the clinical setting. It was difficult to establish communication with these children, particularly during instructions on oral hygiene, where they showed a short attention span.

It can be stated that both ADHDT and SNAP-IV established objective evidence concerning the three ADHD components of hyperactivity, impulsiveness and inattention, which were more prominent in the ADHD group. This suggests that both tests proved useful in a dental office in identifying children with and without ADHD.

A medium correlation was found between ADHDT and SNAP-IV, signifying that there was a concurrence between the judgment of the examiner, a pediatric dentist in this case, and the judgment of the guardian. However, since the ADHDT scores were higher than the SNAP-IV scores, it can be concluded that the guardian overestimated the presence of attention deficiency. The pediatric dentist attended the children in a more controlled and restricted atmosphere than the guardians or parents home environment.

Finally, on a psychometric level, given Crombach's coefficient alphas, it is suggested that both SNAP-IV and ADHDT present a strong internal consistency for the evaluation of the variables that each test claims to measure.

## CONCLUSIONS

Statistically significant differences were found with respect to the orofacial characteristics in both groups. Fissured tongue, deep palate, attrition facets, and

enamel opacities were common features among the ADHD group. Nail biting and bruxism were oral habits more commonly seen in the ADHD group.

Differences were also found with respect to behavioral features in the three areas of inattention, impulsiveness and hyperactivity. Both ADHDT and SNAP-IV proved to be useful to dental practitioners in identifying children with and without ADHD.

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