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Influence of Occlusal Disorders, Food Intake and Oral Hygiene Habits on Dental Caries in Adolescents: A Cross-Sectional Study

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Abstract

Objective: Dental caries is one of the most common oral diseases affecting children and adolescents. The complex multifactorial etiology of caries involves the host's characteristics (saliva and tooth enamel), the oral microflora (bacterial plaque), and the substrate (oral hygiene and diet). The aim of the present epidemiologic study was to calculate the DMFT (Decayed, Missed, Filled Teeth) index and to investigate the association between carious lesions with malocclusions, cariogenic food intake and oral care habits in 12-year-old schoolchildren in Southern Italy.

Materials and methods: The study sample involved school children attending the 2-year secondary school (corresponding to the eighth grade) of state-funded schools in Naples, in the South of Italy. Children were examined to detect dental caries and occlusal variables; moreover, a questionnaire to find out food and oral hygiene habits was obtained. The association among occlusion variables, oral health, dietary habits, and caries was statistically assessed with the one-way ANOVA, the odds ratio and the χ^2 (Chi-Squared test) tests for evaluating the significance. The significance level was set at 0.05.

Results: The study showed a lack of association between diet and oral hygiene and caries prevalence in 12-year-old boys and girls, on the contrary, there was a positive association between crossbite and caries.

Conclusion: Positive relationship was found between dental caries, parents' socioeconomic status and crossbite, whereas carious lesions, food intake, oral hygiene and the other type of occlusal disorder did not reveal any significant association.

Keywords: Carious lesions; Malocclusions; Cariogenic food intake; Oral care habits; Social status

Introduction

Dental caries is a very common oral disease affecting children and adolescents throughout the world, though data from developed countries suggest a decline of dental caries in the last 30 years [1-5] (Table 1).

The complex multifactorial etiology of caries involves the host's characteristics (saliva and tooth enamel), the oral microflora (bacterial plaque), and the substrate (oral hygiene and diet) [3]. Occlusal disorders, like dental crowding and crossbite, may be a risk factor for dental caries. Crowding unsettles normal interproximal tooth contacts with improper embrasures leading to food accumulation and plaque retention [6]. In Italy, relatively few researches have been performed on caries prevalence to date [7-10], sometimes focusing in restricted geographic areas. Even more, poor information is available in literature [11-14]. Thus, more information is needed specially to support some useful prevention programs.

The aim of the present epidemiologic study was to calculate the DMFT (Decayed, Missed, Filled Teeth) index and to investigate the association among carious lesions and malocclusions, cariogenic food intake and oral care habits in 12-year-old school children in Southern Italy.

Materials and Methods

Sample selection

The study sample involved school children attending the 2-year secondary school (corresponding to the eighth grade) of state-funded schools in Naples, in the South of Italy [15]. 48 schools were randomly selected from an initial pool of 79 schools, according to a cluster sample design previously identified by the school district to avoid selection bias ensuing from social heterogeneity. Classes within each school were sampled systematically. All students recruited in the sampled classes were examined, both to improve study feasibility and also to avoid any discriminations among pupils in the same school class. A total of 987 students were randomly selected, and a written consent to perform the examination was obtained from the children and their parents. The sample size was calculated assuming a 50% of prevalence ratio for each characteristic to be estimated, and a precision of the estimate of ± 3 with a 95% confidence interval (sampling from finite population, nQuery Advisor, v. 4.0, Statistical Solution Ltd, Cork, Ireland). This assumption leads to the highest sample size with the given precision.

All the selected children were present at the schools on the day of the examination (867 subjects) participated in the study. Students who had already finished their orthodontic treatment and those who were undergoing a treatment at the time of the study were excluded.

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Authors	Year	Area	Sample Size	Age (Years)	DMFT	Prevalence
Angelillo et al.	1998	Catanzaro	385	12	-	88.1%
Szoke et al.	2000	Ungheria	900	12	-	84.5%
Nieto et al.	2001	Spagna	347	7-12-14	3.91	-
Auad et al.	2009	Brasile	458	13-14	3.95	78%
Mtaya et al.	2009	Tanzania	369	12	-	22%
Migale et al.	2010	Cutro	103	11	2.60	-
Mazza et al.	2010	Burkina Faso	354	12	-	22.9%

Table 1: Prevalence of dental caries and DMFT in 12 year old children.

	DMFT (Mean ± SE)	DT (Mean ± SE)	MT (Mean ± SE)	FT (Mean ± SE)
Total	1.88 ± 0.09	1.52 ± 0.08	0.07 ± 0.02	0.28 ± 0.04
Boys	1.71 ± 012	1.36 ± 0.11	0.07 ± 0.03	0.28 ± 0.05
Girls	2.02 ± 0.13	1.65 ± 0.12	0.07 ± 0.02	0.29 ± 0.05
ANOVA	F=2.94; p=0.09	F=3.32; p=0.07	F=0.00; p=0.97	F=0.06; p=0.80

Table 2: Caries index and subcomponents by total population and gender.

Therefore, the final sample to analyze comprised of 536 orthodontically untreated subjects.

The students were examined in a quiet classroom of their school without external interference, under natural or artificial illumination, approximately for 15 minutes. The dental occlusion assessment was carried out using latex gloves, sterile dental mouth mirrors and millimeter rulers. Personal data and information about orthodontic treatment were obtained directly from each student. No radiographs, study casts, or previous written records were used. The two examiners (Prof. Perillo and Dr. Giugliano) had previously undergone calibration to standardize their procedures before carried out clinical examination. The examination was focused on oral hygiene, occlusal variables and the evaluation of decayed (D), missing (M) and filled (F) teeth (T), or DMFT index [16]. Missing teeth were considered only if they were missing for caries [17,18].

The orthodontic variables considered were molar relationship, overjet and overbite, posterior crossbite, scissor bite, crowding and diastema. In particular, the molar relationship was determined like the relationship between the upper and lower first permanent molars according to the Angle's classification; patients with subdivision malocclusions were included in the Class II or Class III groups on the basis of the predominant occlusal characteristic, or of the relationship between the canines. Overjet and overbite with values between 0 and 4 mm were considered normal. A posterior crossbite, unilateral (right or left) or bilateral, was diagnosed when a crossover of at least one tooth was detected in the posterior segments of the dental arches. A scissor bite was considered when the palatal cusps of the upper molars were positioned buccally in relation to the buccal cusps of the lower molars. Crowding and diastema were recorded for the anterior or the posterior segments. A midline diastema was considered to be present when there was a space of at least 2 mm between the maxillary central incisors.

Questionnaire

Information about oral hygiene and dietary habits was obtained with a questionnaire on daily oral hygiene practices, intake and frequency of different types of foods (i.e., carbohydrates, dairy products, sweets). The frequency of dental check-ups was also investigated.

Regarding parents' scholarly level, a distinction was made between low educational level (no education or compulsory schooling) and high/medium educational level (apprenticeship training, vocational school, high school or higher education) [5,17,19].

Statistical analysis

DMFT values for each subject were used. The association between occlusion variables, oral health, dietary habits, and caries was assessed with the one-way ANOVA, the odds ratio and the χ^2 tests for evaluating the statistical significance. The significance level was set at 0.05.

Results

The study sample was composed of 536, 12-year old students (283 females, 253 males). Dental caries were recorded in 321 (59.8%) students. No difference was observed in the prevalence of caries between gender (χ^2=0.70, p=0.40) or the different school districts (χ^2=5.52, p=0.70). The mean value of DMFT was 1.81 ± 2.02 (1.94 ± 2.11 in girls and 1.67 ± 1.9 in boys, one-way ANOVA F=0.77, p=0.65); the decay (D) component was the most represented (1.45 ± 1.80) (Table 2). The first permanent maxilla molar was the most affected by caries (46.83%) and the least prevalence was for the lateral incisors (0.34%) (Table 3).

Table 4 showed the distribution of the sample according to the occlusal variables. The first molar class was the most represented occlusion (59.41%), followed by second (35.66%) and third (4.94%) class. Overjet and overbite were normal for most students. A midline deviation was detected in the 32.09% of the sample, while the presence of crossbite was recorded in the 11.75% of the sample. Crossbite was the only occlusal variable significantly associated to caries experience (χ^2=3.96, p=0.04) (Tables 5 and 6). Crowding was more present in subjects with caries experience but not statistically significant (χ^2=1.95, p=0.09) (Table 7).

No statistically significant relation between caries and food habits was found. In particular, no correlation between carbohydrates consumption and caries (χ^2=1.89, p=0.1) (Table 8), nor daily diary consumption and caries prevention (χ^2=2.1, p=0.08) (Table 9). Positive association was found between the scholarly level of mothers (χ^2= 7.74, p<0.01) and fathers (χ^2= 6.35, P=0.01), and the presence of caries (Table 10).

No association was found in group of adolescents brushing their teeth more time a day than who did not brush them assiduously (χ^2=5.15; p=0.27) (Table 11).

Discussion

This study was designed and carried out in the schools of Naples, one of the most populous cities in Italy and one with the highest birth

rates. The OMS goal for the year 2000, i.e. a DMFT value ≤ 3, was reached and in agreement with the results of other surveys [10,20,21].

D value in the DMFT score was always the highest; the variations observed among the different districts for mean values of DMFT may

Dental elements	Maxillary		Mandibular	
	Right%	Left%	Right%	Left%
Permanent central incisor	1.06	-	-	-
Permanent lateral incisor	-	0.34	0.34	-
Deciduous canine	-	-	-	-
Permanent canine	-	-	0.70	-
First deciduous molar	0.34	-	-	-
Second deciduous molar	2.82	1.75	2.11	2.82
Permanent first premolar	2.45	2.11	0.70	1.06
Permanent second premolar	1.06	1.06	1.41	0.70
First permanent molar	46.83	36.27	40.84	25.00
Second permanent molar	9.86	7.38	10.55	11.62

Table 3: Caries prevalence.

Occlusal Variables	Number of Subjects (%)
Molar class I	307 (57.37)
Canine class II	11 (2.04)
Canine class III	-
Molar class II	184 (34.33)
Class II, II division	7 (1.33)
Molar class III	26 (4.94)
Overjet >4 mm	3 (0.56)
Overjet 0-4 mm	446 (83.21)
Overjet <0 mm	87 (16.22)
Overbite > 4 mm	3 (0.56)
Overbite 0-4 mm	427 (79.65)
Overbite <0 mm	106 (19.76)
Median line	172 (32.09)
Crossbite	63 (11.75)
Monolateral crossbite	51 (9.51)
Bilateral crossbite	12 (2.24)
Crowding	253 (47.20)
Diastema	123 (22.95)

Table 4: Frequency of occlusal variables in the sample.

Category	DMFT>0 n (%)	DMFT=0 n (%)	OR (95% CI)
Class I	176 (54.83)	131 (60.92)	1.34 (1.07/1.68)
Class I with>OVJ	7 (2.18)	4 (1.86)	1.75 (0.51/5.98)
Class II, division I	113 (35%)	71 (33%)	1.6 (1.04/1.91)
Class II, division II	4 (1.25)	3 (1.40)	1.33 (0.30/5.96)
Class III	14 (4.36)	3 (1.40)	4.67 (1.34/16.24)
Class III, subdivision	7 (2.18)	3 (1.40)	2.33 (0.60/9.02)

χ^2 for trend = 3.55; p=0.04

Table 5: Caries prevalence (DMFT>0) across malocclusion.

	DMFT=0 n (%)	DMFT>0 n (%)	χ^2 for trend; p-value
Crossbite	39 (61.90)	24 (38.09)	3.96; 0.04*

Table 6: Caries prevalence (DMFT>0) and crossbite.

	DMFT=0 n (%)	DMFT>0 n (%)	χ^2 for trend; p-value
Dental crowding	130 (51.37)	123 (48.62)	1.95; 0.09

Table 7: Caries prevalence (DMFT>0) and crowding.

Carbohydrate	DMFT>0 n (%)	DMFT=0 n (%)	χ^2 for trend p-value
Sweets*			
None	24 (8.45)	26 (10.31)	
Low	114 (40.14)	97 (38.49)	
Normal	70 (24.64)	73 (28.96)	
High	76 (26.76)	56 (22.22)	1.89 0.1
Cake**			
None	24 (8.4)	22 (8.73)	
Low	104 (36.61)	101 (40.07)	
Normal	87 (29.57)	74 (29.36)	
High	69 (24.29)	55 (21.82)	
Sweet Snacks	122 (42.95)	108 (42.85)	

*Sweets: None (no sweets), low (seldom), normal (1-2 times per day), high (>twice a day)
**Cake: None (no cake), low (seldom), normal (once a day), high (>once a day)

Table 8: Correlation between prevalence of caries and carbohydrate.

	DMFT>0 (n%)	DMFT=0 (n%)	χ^2 for trend p-value
Dairy*			
None	37 (58.72)	26 (41.27)	
Low	57 (54.81)	47 (45.18)	2.1 0.08
Normal	150 (50.00)	150 (50.00)	
High	40 (57.96)	29 (42.03)	

*None (no dairy), low (<twice a week), normal (2-4 times per week), high (>4 times per week)

Table 9: Correlation between prevalence of caries and dairy products.

Education	DMFT>0 n (%)	DMFT=0 n (%)	OR (95% CI)	χ^2 for trend p-value
Mother				
Low grade	72 (27.91)	38 (21.60)	1.90 (1.28/2.80)	7.74 <0.01*
Medium grade	80 (31.00)	45 (25.57)	1.78 (1.23/2.56)	
College	79 (30.62)	58 (32.95)	1.36 (0.97/1.91)	
Degree	27 (10.47)	35 (19.88)	0.77 (0.47/1.27)	
Father				
Low grade	51 (20.00)	22 (12.72)	2.31 (1.40/14.86)	6.35 0.01*
Medium grade	88 (34.51)	56 (32.37)	1.57 (1.12/2.20)	
College	76 (29.80)	55 (31.79)	1.38 (0.98/1.95)	
Degree	40 (15.69)	40 (23.12)	1.00 (0.64/1.55)	

Table 10: Caries prevalence (DMFT>0) across parents scholarly level.

Frequency	DMFT>0 n (%)	DMFT=0 n (%)	p-value
Never	11 (7.74)	7 (2.77)	-
Once a day	24 (8.45)	21 (30.55)	-
2 times a day	99 (34.85)	77 (30.55)	5.15
3 times a day	107 (37.67)	117 (46.43)	0.27
4 times a day	42 (14.78)	30 (11.90)	-

Table 11: Prevalence of caries and brushing teeth.

be due to social and/or cultural differences [7,22,23]. Higher values of DMFT were found in students who had no intake of milk or dairy products. This finding may be in line with earlier studies showing that milk and dairy products consumption was associated with a less frequency of caries even if in this report the correlation was present but not statistically significant unlike other studies [22,24-26], this discrepancy is probably due to the multifaceted etiology of caries.

In the last few years, a distinct association between oral hygiene and prevention of dental caries has been demonstrated [27-29]. Studies found out that the prevalence of caries was not related to correct oral hygiene practices, as also reported in other surveys, strengthening the

hypothesis of a multifactorial origin of caries [9,14,23,25,27-34]. Several studies evaluating the relationship between crowding and dental caries have shown contradictory results, probably due to small sample size included in the studies [33,35,36].

The hypothesis that occlusal disorders may increase the risk of caries was also tested. The need of any orthodontic treatment should not be linked to a decreased risk of future caries, although the higher prevalence of caries was associated with the crossbite [30,32,37]. Today, the malocclusions and space anomalies are mainly not considered as predictors of caries [31]. However, further studies are needed to monitor whether South Italy students will achieve the ambitious DMFT goal of <1.5 for the year 2020 [17,18,38-41].

Conclusion

Positive relationship was found between dental caries, parents' educational status and crossbite, whereas carious lesions, food intake, oral hygiene and the other type of occlusal disorder did not reveal any significant association in 12-year-old school children of Naples in the Southern Italy.

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