

Prevalence of Black Stain and Dental Caries in Children Attending a University Pediatric Dentistry Clinic in Istanbul

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ÖZET

İstanbul'daki bir üniversite pedodonti kliniğine başvuran çocuklarda siyah dışsal renkleşme ve diş çürüğü prevalansının değerlendirilmesi

Amaç: Bu çalışmanın amacı İstanbul'da bir üniversite pedodonti kliniğine başvuran çocuklarda siyah dışsal renkleşme ve diş çürüğü prevalansının literatürdeki diğer ülkelerle karşılaştırılmasıdır.

Yöntem: İstanbul ilinde yaşayan beş ila on üç yaş arasında diş tedavisi için Marmara Üniversitesi Pedodonti kliniğine başvuran; 325 (167 erkek, 158 kız) çocuktan oluşan çalışma grubunda siyah dışsal renkleşme varlığı ve diş çürüğü Dünya Sağlık Örgütü df-t/ DMF-T indeksiyle değerlendirildi.

Bulgular: Siyah dışsal renkleşme 60 (27 erkek, 33 kız) çocukta, grubun %18.5'inde saptandı. Ortalama df-t ve DMF-T değerleri siyah dışsal renkleşmesi olan çocuklar (3.67 ± 3.25 ; 1.39 ± 1.68) ile siyah dışsal renkleşmesi olmayan çocuklar (4.29 ± 3.48 ; 1.79 ± 2) arasında fark göstermedi ($p > 0.05$). Siyah dışsal renkleşmesi olan ve olmayan çocukların sayısı DMF-T ve df-t değerlerine, cinsiyete, ebeveyn eğitim seviyesine ve diş fırçalama sıklığına göre fark göstermedi ($p > 0.05$).

Sonuçlar: Ortalama df-t ve DMF-T değerleri, siyah dışsal renkleşmesi olan ve olmayan çocuklar arasında anlamlı fark göstermedi. Siyah dışsal renkleşme ile df-t ve DMF-T değerleri arasında anlamlı ilişki saptanmadı. Çalışmamıza dahil olan çocuklarda siyah dışsal renkleşme prevalansı literatürdeki Brezilya, İtalya, Almanya, İspanya, Polonya, Filipinler, Hindistan, Yunanistan ve Çin'deki çocuklardakinden daha yüksek, İsviçre ve Birleşik Krallık'taki çocuklardakinden daha düşük bulundu.

Anahtar sözcükler: Siyah dışsal renkleşme, diş çürüğü, çocuklar

ABSTRACT

Prevalence of black stain and dental caries in children attending a university pediatric dentistry clinic in Istanbul

Objective: The purpose of the present study is to investigate the prevalence of black stain and dental caries in Istanbul schoolchildren attending a university pediatric dentistry clinic and compare it with the literature findings from other countries.

Methods: Presence of black stain and WHO df-t/DMF-T scores were recorded from randomly selected 325 (boys: 167, girls: 158) schoolchildren between 5 to 13 years of age who reside in Istanbul and attend Marmara University Pediatric Dentistry Clinic.

Results: Black stain was observed in 60 children (27 boys, 33 girls). The overall percentage of children affected by black stain was 18.5%. The mean df-t, DMF-T scores for children with black stain (3.67 ± 3.25 ; 1.39 ± 1.68) did not differ from children without black stain (4.29 ± 3.48 ; 1.79 ± 2) ($p > 0.05$). Number of children with and without black stain did not differ according to DMF-T and df-t scores, gender, parental education levels and toothbrushing frequency ($p > 0.05$).

Conclusions: The mean df-t and DMF-T scores were not statistically different between the groups with stain and without stain. Black staining and df-t, DMF-T scores were not associated with each other. The prevalence of staining in our sample was found higher than the prevalence reported from Brazil, Italy, Germany, Spain, Poland, Philippines, India, Greece, and China but lower than those reported from Switzerland and United Kingdom.

Key words: Black stain, dental caries, children

INTRODUCTION

Tooth discoloration is a frequent dental finding associated with clinical and aesthetic problems. It differs in etiology, appearance, composition, location, severity and degree of adherence (1). There are three types of tooth discolorations: Extrinsic, intrinsic and internalized

discolorations. Extrinsic stains are caused by extrinsic agents and located on the outer surface of the teeth. Intrinsic stains result from the incorporation of pigmented materials into dentinal tissues. The third category of 'stain internalization' has been described as to include those circumstances where extrinsic stain infiltrates through the defects in the tooth structure (2,3).

Table 1: Prevalence of Black Stain in Different Countries

Author	Year	Country	Age	Prevalence %	Number Of Children
Gülzow	1963	Switzerland	7-15	19.90	2127
Sutcliffe	1967	United Kingdom	11-13	21.00	1000
Surdacka	1987	Poland	4-16	4.50	3125
Koch	1996	Germany	6-11	4.00	801
Koch	2001	Italy	6-12	6.30	1086
Gasperetto	2003	Brazil	6-12	14.80	263
Paredes Gallardo	2005	Spain	4-11	7.54	1100
Heinrich-Weltzien	2009	Philippines	10-13	16	1718
Bhat	2010	India	7-11	18	1472
Franca-Pinto	2012	Brazil	5	3.5	1129
Boka et al	2013	Greece	3- 5.5	2.4	804
Chen et al	2014	China	4-6	9.9	1397

Black stain is characterized by distinctive dark dots to continuous lines, which are localized at the tooth surface parallel to the gingiva. Tooth brushing at home is not enough to remove this external stain and professional cleaning procedures are necessary to solve this aesthetic problem. Although a simple scaling and tooth brushing with pumice usually can remove the stain, frequently black stain formation is repetitive (4).

Different prevalence for black stain are reported in the literature (Table 1). The first study to characterize the structure and composition of black stain was made by Bibby (5) in 1931. This particular type of pigmentation has been considered to be a special form of dental plaque that differs from other types because it contains insoluble iron salt and a high content of copper, calcium and phosphate (6,8). The chemical composition of saliva in children with black stain is characteristic of subjects with low susceptibility to caries according to the lower glucose and higher calcium, phosphate content (6,9).

Investigation of the chemical composition of the saliva in children aged 4-16 years with black stains demonstrated a significantly higher content of total calcium, inorganic phosphates, copper, sodium and total protein and less glucose than in controls. This chemical composition is characteristic of subjects with low susceptibility to caries (9). Although no significant difference was found in the amounts of saliva secreted between the children with black stain and without black stain, the pH of the saliva was found significantly higher in children with black stain (10). Garan et al. (11) reported higher calcium levels and buffering capacity in children with black stain than in children without black stain.

The black material is a ferric salt, probably ferric sulphide, formed by the reaction between the hydrogen sulphide produced by bacterial action and iron in the saliva or gingival exudates (7). Although its origin remains somehow obscure, an association with chromogenic bacteria such as *Actinomyces* and *Prevotella melaninogenica* has been reported in the literature (3,6,7,9,12).

Oral flora of black stain-affected individuals seems to be different. Origin of black stain in a polymerase chain reaction (PCR) microbiological study showed that *Actinomyces* could be involved in the occurrence of pigmentation because its presence was demonstrated in 50% of the patients with black stain (13). Another possible outcome of this different microflora is reported to be low *Streptococcus mutans* levels in biofilm, resulting in decreased susceptibility to caries (14).

This study aimed to assess the prevalence of black stain in Istanbul schoolchildren attending a university pediatric dentistry clinic to represent Turkish schoolchildren and determine possible association between black stain and dental caries.

MATERIAL AND METHODS

Study sample was selected from children referred to Marmara University, School of Dentistry, Department of Pediatric Dentistry for dental treatment. The study was cross-sectional in design and conducted in full accordance with ethical principles, including the World Medical Association Declaration of Helsinki (version, 2008 <http://www.wma.net/en/30publications/10policies/b3/>). Ethical approval for the study was obtained from Research Ethics

Table 2: Prevalence of Black Stain and Dental Caries

	Black Stain (+)		Black Stain (-)		Total	
	n	%	n	%	n	%
Caries-free	8	2.5	21	6.5	29	9
With caries	52	16	244	75	296	91
Total	60	18.5	265	81.5	325	100

Table 3: Median df-t, DMF-T Values of Children with and without Black Stain

	Black Stain (+)			Black Stain (-)			p
	median	25 th percentile	75 th percentile	median	25 th percentile	75 th percentile	
df-t	4	1	5	4	4	5	0.233
DMF-T	2	0	2	2	2	2	0.16

Mann-Whitney U test used.

Committee of Marmara University (Protocol Number 163). The parents were given clear explanation about the objective of the study and informed consent was taken along with the child's approval to participate. The 95% confidence interval level and a 14.8% prevalence of black stain was used for the calculation according to the study by Gasparetto et al (15), size of the sample was calculated to give a margin of error of 5% or less. According to these calculations minimum sample size to satisfy the requirements was estimated to be 200 children. A questionnaire inquiring the tooth brushing frequency and parental education level was filled for each subject by the same researcher.

The inclusion criteria included the following:

1. Age above 5 years (started primary school)
2. No systemic disease
3. Not using mouth rinses
4. Not taking ferrous sulphide supplements

This was followed by oral examination. Teeth were examined under dental light reflector with a probe and mirror for the presence of black stain and dental caries. The clinical diagnosis of the black stain was performed according to the presence of dark adherent pigmented lines in the cervical portion of the teeth. The children were classified as; with black stain and without black stain. Dental caries examinations were performed by the same clinician according to WHO criteria (16). Caries scores were composed of number of decayed teeth (D: for permanent

dentition, d: for primary dentition), number of missing teeth (M: for permanent dentition) and number of filled teeth (F: for permanent dentition, f: for primary teeth). Before the study was initiated, all parents and/or guardians were informed of the objective of the study and a written consent was obtained for the participation of each child in this study.

Statistical Analysis

Continuous variables were compared by Mann-Whitney U test since the data did not show normal distribution. Categorical variables were analyzed by the chi-square test. Statistical analysis was performed using the Statistical Program of Social Science (SPSS 16) for Windows. Statistical significance was considered at the 5% level.

RESULTS

Black stain was observed in 60 children (18.5%) (Table 2). The mean df-t, DMF-T scores were 3.67 ± 3.25 ; 1.39 ± 1.68 for children with black stain, whereas the scores were 4.29 ± 3.48 ; 1.79 ± 2 for children without black stain, respectively; the difference was not significant ($p=0.233$, $p=0.16$) (Table 3). Number of children with and without black stain did not differ according to DMF-T ($p=0.991$) and df-t ($p=0.120$) scores, gender ($p=0.273$), parental education levels ($p=0.257$, $p=0.712$) and toothbrushing frequency ($p=0.139$) (Table 4).

Table 4: df-t, DMF- T, Gender, Parental Education and Brushing Frequency Comparison in Study Groups

		Black Stain (-) n (row %)	Black Stain (+) n (row %)	p (Chi square test)
df-t	0	50 (85.29%)	18 (14.71%)	χ^2 :5.83 p=0.120
	1—5	126 (85.71%)	21 (14.28%)	
	6—10	73 (79.34%)	19 (20.65%)	
	> 10	16 (88.88%)	2 (11.11%)	
DMF-T	0	114 (81.42%)	26 (18.57%)	χ^2 :0.017 p=0.991
	1—5	142 (81.60%)	32 (18.39%)	
	6—10	9 (81.81%)	2 (18.18%)	
Gender	Girls	125 (79.11%)	33 (20.88%)	χ^2 :1.20 p=0.273
	Boys	140 (83.83%)	27 (16.16%)	
Mother's Education	Primary school	160 (78.81%)	43 (21.18%)	χ^2 :2.72 p=0.257
	High School	58 (85.29%)	10 (14.70%)	
	University	47 (87.03%)	7 (12.96%)	
Father's Education	Primary School	119 (79.86%)	30 (20.13%)	χ^2 :0.68 p=0.712
	High School	84 (84.00%)	16 (16.00%)	
	University	62 (81.57%)	14 (18.42%)	
Brushing Frequency	None	33 (84.61%)	6 (15.38%)	χ^2 :5.50 p=0.139
	Once a day	52 (91.22%)	5 (8.77%)	
	Twice a day	51 (76.11%)	16 (21.05%)	
	Irregular	129 (79.62%)	33 (20.37%)	

DISCUSSION

Black stain is a common discoloration in children. Its negative effect on the dental aesthetic perception causes concerns in parents and can have significant effects on the personality and self-confidence of the child.

Black stain prevalence is reported to be 2.4-21% in literature. In our study the black stain prevalence was 18.5%, higher than the prevalence obtained in the studies from Brazil, Italy, Germany, Spain, Poland, Philippines, India, Greece, China but lower than those reported from Switzerland and United Kingdom (12,15,17-26). These different prevalence values may be caused by the differences in eating/oral hygiene habits, related oral microbiological differences and also population sampling methods employed in these studies (4). Black stain prevalence was not different among boys and girls in our study, in agreement with previous studies (18,24,26).

Black stain occurrence has been associated with lower risk for caries in preschoolers by França- Pinto et al. (19), Boka et al. (25) and Chen et al. (26). Bhat (22) reported lower caries experience in 7-11 year olds and Sutcliffe (24) in 11-13 year olds with black stain. Koch et al. (12) found higher DMF-T scores in 6-11 year old elementary school

children without black stain but the difference was not significant. Gasparetto et al. (15) also reported higher caries experience in 6-12 year old children without black stain but significance of this difference was not statistically tested. In our study df-t and DMF-T scores were lower in children with black stain than the values obtained from their peers without, but the difference was not statistically significant. Inclusion of a group of children from a wide age range may be the reason of this result. Although black stain is well known in the dental community its occurrence has seldom been examined with lower caries experience in adults as in children. Schmully et al. (27) in a clinical setting reported lower DMFT scores in young adults with black stain than those without.

Costa et al. (28) showed that *S. mutans* was present in the biofilms of both black stain and control samples. Also, our previous reverse transcription polymerase chain reaction (RT-PCR) study in black stain and control patients of 6-12 year old children showed lower *S. mutans* levels in the biofilm of the black stain group (14). These results suggest that rather than a total absence of *S. mutans* in dental biofilm, maybe there is a less accommodating oral balance existing to cause its lower levels in black stain patients.

França- Pinto et al. (19) reported higher black stain prevalence in children of less educated mothers and of lower income families. Conversely, Chen et al. (26) found children with higher parental education were more likely to have black stain. Parental education was not associated with black stain presence in our study.

Black stain is a form of bacterial plaque and oral hygiene measures are expected to be relevant to its formation. In the study by Heinrich-Weltzien et al. (21), daily oral hygiene interceptive school programme did not cause different black stain prevalence values among control and school programme group. Chen et al. (26) reported that brushing frequency was not related to black stain occurrence and degree of visible plaques was lower in children with black stain. Sutcliffe (24) reported oral cleanliness was not different in their groups with and without black stain. According to Gülzow (23), black stain incidence increases up to 13-14 years of age and beyond this point, decline in its incidence is observed because of improved oral hygiene habits. Surdacka (20) reported that the children with black stain had a better oral hygiene and better gingival health. Brushing frequency was not associated with black stain presence in our study. Efficiency of dental plaque removal

might to be more relevant in black stain formation rather than brushing frequency.

Three hundred and twenty five children were screened for black stain in our study, though the total number of participants is less than those in similar studies, the aim of our study was to determine black stain prevalence as a preliminary effort in a clinical setting. The majority of the sample was patients from middle and low income status applying for dental treatment covered by the national insurance agency. The major shortcoming of our study is the setting, because screening in patients seeking dental treatment might have affected our sample's ability to reflect black stain prevalence and caries risk. Many of the similar studies were conducted in the field as cross-sectional school screenings and this approach seems to be both convenient and reliable because the problem seems to be at its height during primary and mixed dentition (12,15,20-22).

Reported black stain prevalence is different among studies in the literature. Caries experience was lower in children with black stain in our study. Future studies should focus on the treatment aspect of this esthetic problem.

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