





Contribution of preventive methods in controlling caries among Saudi primary schoolchildren: a population-based cross-sectional study

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ABSTRACT

Objective: This study assessed the association between caries preventive measures including regular dental checkups, twice a day tooth brushing using fluoridated toothpaste and pit and fissure sealants on one side and the presence of caries among primary schoolchildren in the Eastern Province of Saudi Arabia.

Materials and methods: A cross-sectional study was conducted in 2016 including 1198, 6–12-year-old children from 13 randomly selected schools. The outcome variable was caries presence. The explanatory variables were brushing twice a day using fluoridated toothpaste, the presence of sealant and regular dental checkups. Multivariable logistic regression model was conducted to assess the associations controlling for confounders (age, gender, ability to get treatment, being health insured and school) using SPSS version 20.0.

Results: Data of 921 participants (83.8%) were available. The prevalence of caries was 63.5%, whereas 67.6% brushed their teeth twice a day, 28.3% visited the dentist for regular checkups and 7.6% had sealant. In multivariable regression, out of the three main explanatory variables, only having regular checkups was significantly associated with caries presence (OR = 0.65, 95% CI = 0.48, 0.88).

Conclusions: Lower odds of caries presence were associated with regular dental checkups but not with regular brushing or having sealant.

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Introduction

Dental caries is one of the most prevalent diseases affecting more than one-third of the world's population, and is a cause of concern in school age children [1]. Poor oral health in children can adversely affect their overall health, growth, development, school performance and daily activities [2].

Preventive measures may be defined as those used for protection from disease to preserve the health of individuals [3]. Preventive dental visits include the application of fluoride varnish and fissure sealant as well as dietary counselling and oral hygiene instructions and can potentially decrease the need for restorative and emergency care and their financial burden [2,4]. At home, caries preventive measures such as tooth brushing using fluoridated toothpaste have been recommended for caries prevention and control [5]. A Nigerian study found that children who brushed more than once a day using fluoridated toothpaste had lower caries risk (adjusted odds ratio = 0.28) [5]. Another study found that 12-year-old Indian children who brushed less than once a day showed higher odds of caries than those who brushed more often (OR = 1.36) [6]. Although fluorides were useful in preventing caries in smooth surfaces [7], they are less effective in protecting pits and fissures in occlusal surfaces [8]. Pit and fissure sealants were developed to target these

challenging sites, which are anatomically more liable to the entrapment of debris and microorganisms. A systematic review reported that resin-based sealant was more effective compared to no sealant in preventing occlusal caries in children aged 7 years and more after 2 years follow-up, OR = 0.15 (95% CI = 0.08–0.27) [8].

The effectiveness of these caries prevention measures has long been documented [3]. Nonetheless, evidence shows that they are underutilized [9] and that efforts are continuously needed to promote their use. Such efforts need to be guided by the relative effectiveness of these methods as they actually exist among populations. This approach would reflect the levels of use based on real life and interconnected factors such as provider and patient preferences as well as health care system characteristics.

Previous studies conducted in Saudi Arabia showed that the frequency of tooth brushing among schoolchildren was modest [10] and that dental visits for regular checkups had low prevalence [11], with a small portion of children having sealant on permanent teeth [9]. Saudis have access to dental health care services through governmental clinics free of cost. However, due to high demand resulting in long waiting lists, a considerable portion of the population may visit private clinics. Some employees are covered by private health insurance as part of their job benefits although it does not

always cover dental services [12]. In spite of universal access to care, caries problem has been consistently reported among 6–12-year-old Saudi children with prevalence ranging from 70% to 80% in the last decade [13]. This agrees with the situation in other countries undergoing social and economic transition [14].

There is a need to control this high level of caries especially in areas or settings where caries preventive measures are underutilized. The aim of this study was to assess the relationship between caries preventive measures including regular dental visits for checkup, tooth brushing using fluoridated toothpaste twice a day and having sealants on one hand and on the other hand, the presence of caries among primary schoolchildren in the Eastern Province in Saudi Arabia.

Materials and methods

The data included in the present report were obtained from a larger cross sectional survey assessing the oral health of 6–12-year-old schoolchildren in the Eastern Province, Saudi Arabia which aimed to eventually include 3000 children. Ethical approval of the Institutional Review Board (IRB – 201702-048) of Imam Abdulrahman Bin Faisal University was obtained. Data were collected from September to December 2016. Thirteen schools were randomly selected from seven cities in the Eastern Province that were to be included in this stage of the survey: Dammam, Khobar, Dhahran, Qatif, Saihat, Anak and UmulSahik. The Directorate of Education in the Eastern Province was asked to select public primary schools stratified by region (city) with proportional allocation of children to represent the population size in the cities. Children were included if they were free from systemic diseases (physical and intellectual disabilities, diabetes mellitus, asthma, kidney problems and cardiovascular diseases) and their parents consented to their participation. The present report included data from the first stage of the survey with 1198 children participating.

Data were collected following the methodology of the Basic Screening Survey developed by the Association for State and territorial Dental Directors [15] and using a questionnaire and a clinical examination. The questionnaire was translated into Arabic then pilot-tested for clarity on 20 parents visiting the clinics of the College of Dentistry, Imam Abdulrahman Bin Faisal University. It was translated back to English to validate the translation. A cover letter preceding the questionnaire explained the study purpose and asked for parental consent. The questionnaire included eight questions: seven of which were close-ended with an 8th question where the respondent added a number. Four questions were about age, gender, insurance covering the cost of dental treatment and whether treatment could be obtained when needed. Two questions assessed the frequency of brushing and whether fluoridated toothpaste was used. The last two questions inquired whether the child had visited the dentist previously (yes/no), and if the visit was for regular checkup or other reasons. The questionnaire was delivered to the contact person in the school one week before clinical

examination. It was sent home with the child to be filled by the parent. The study team later collected the filled forms and identified those whose parents consented to their participation.

On the day of the visit, clinical examination was conducted by three dentists who were previously calibrated on detecting caries with an experienced gold standard examiner to an acceptable level of agreement ($Kappa \geq 0.6$). Following the methods and criteria of the Basic Screening Survey [15], examination was conducted with disposable mirrors for tissue retraction and indirect vision and explorers to remove food debris. A portable light source (Aseptico, WA) was used and the child was seated on a portable dental chair in an area designated for study purposes by the school authorities. The presence of caries was recorded at person level and was defined as an open carious lesion detected visually on any tooth whether primary or permanent. Sealant presence on permanent molars was also assessed visually and the explorer was moved on the occlusal surface to ascertain its presence.

The outcome variable was the presence of caries. The three explanatory variables were (1) reported (by parents) brushing twice a day using fluoridated toothpaste (recoded from the two brushing variables collected in the questionnaire), (2) the presence of pit and fissure sealant on any permanent molar and (3) visiting the dentist for regular checkups. The following four variables were included in the analysis as confounders: age, gender, being health insured and inability to obtain dental treatment when needed. Univariate logistic regression models were used to assess the association of each one of the explanatory variables and confounders with the outcome variable. A multivariable logistic regression model was conducted to assess the relationship of the three explanatory variables with the outcome variable adjusting for the effect of the four confounders. Analysis was performed using SPSS version 22.0 (IBM Corp., Armonk, NY, USA). Significance level was set at 5%.

Results

The questionnaire was distributed to 1198 children and returned by 1005 (response rate=83.8%). Some children were not examined because their parents did not consent, they were absent or busy in other school activities during the time of examination ($n=84$). Data of the remaining 921 were included in the analysis.

The mean (SD) age of children was 8.9 (2.8) years, ranging from 5.8 to 12.3 years and 48.3% of them were boys. The percentage of children whose parents reported having health insurance was 45.7% and 28.0% needed treatment in the last year but could not obtain it. The prevalence of brushing twice a day using fluoridated toothpaste was 67.6% while 28.3% visited the dentist for regular checkups. Sealant was clinically detected on the permanent molars of 7.6% of children (Table 1). Caries was detected in 585 children (63.5%).

In univariate regression (Table 1), significantly lower odds of caries presence were associated with increasing age ($OR=0.95$, 95% $CI=0.92$, 0.98), having health insurance

Table 1. Relationship between caries presence and tooth brushing using fluoridated toothpaste, presence of sealant on permanent molars and regular dental checkups in the Eastern Province of Saudi Arabia.

	N (%)	OR (95% CI)	
		Univariate model	Multivariable model
Age (years): mean (SD)	8.9 (2.8)	0.95 (0.92, 0.98)*	1.12 (1.03, 1.21)*
Males	445 (48.3)	0.95 (0.81, 1.12)	1.47 (1.11, 1.95)*
Has health insurance	421 (45.7)	0.74 (0.63, 0.87)*	0.92 (0.69, 1.21)
Needed treatment in the last year but could not get it	258 (28.0)	2.03 (1.69, 2.45)*	1.64 (1.18, 2.29)*
Brushes twice a day using fluoridated toothpaste	623 (67.6)	0.99 (0.85, 1.15)	0.77 (0.57, 1.05)
Presence of pit and fissure sealant on permanent molars	70 (7.6)	0.54 (0.41, 0.71)*	0.63 (0.38, 1.05)
Visits the dentist for regular checkups	261 (28.3)	0.55 (0.44, 0.69)*	0.65 (0.48, 0.88)*

OR: odds ratio; CI: confidence interval.

Multivariable model: including tooth brushing, presence of sealant and visiting for checkups adjusted for age, gender, ability to obtain treatment when needed, being health insured and school effect.

*Statistically significant at $p < .05$.

(OR = 0.74, 95% CI = 0.63, 0.87), having pit and fissure sealant (OR = 0.54, 95% CI = 0.41, 0.71) and visiting the dentist for regular checkups (OR = 0.55, 95% CI = 0.44, 0.69). Significantly higher odds of caries were associated with being in need of treatment but not obtaining it (OR = 2.03, 95% CI = 1.69, 2.45). There was no significant association between the presence of caries and gender or twice a day brushing using fluoridated toothpaste.

In the multivariable model where all three preventive methods were included, only visiting the dentist for regular checkups was significantly associated with lower odds of caries presence (OR = 0.65, 95% CI = 0.48, 0.88). Three confounders were significantly associated with higher odds of caries presence; age (OR = 1.12, 95% CI = 1.03, 1.21), male gender (OR = 1.47, 95% CI = 1.11, 1.95) and being in need of dental treatment but not obtaining it (OR = 1.64, 95% CI = 1.18, 2.29).

Discussion

Our study showed that when different preventive measures were compared, regular checkups were associated with significantly less caries presence. Tooth brushing using fluoridated toothpaste and pit and fissure sealant, on the other hand, had no significant relationship with caries in multivariable regression. Our findings have implications for health policy aiming at the selection of preventive strategies to control the high prevalence of caries among schoolchildren in the Eastern Province of Saudi Arabia and similar settings. Based on our findings, it is important to ensure access to health services and to promote regular checkups so that dentists can monitor oral health and apply preventive methods tailored to the needs of individual children. Such an approach complements practices performed by children at home such as tooth brushing and professional procedures which focus on one aspect only of oral health such as prevention of occlusal caries using sealants.

In the present study, health insurance coverage was associated with lower odds of caries. The presence of this association in spite of the universal access to care offered in the Saudi health care system [16] may be attributed to the types of facilities the study population used. Parents might have sought treatment for their children in private practices rather than governmental/public facilities. In this case, health

insurance would be an important enabler in securing access to care to prevent and/or treat caries. Our results agree with a systematic review which reported a protective effect of health insurance coverage on caries prevention [1].

In the current study, inability to access care was associated with higher odds of caries presence. This agrees with a study conducted in the US which noted that improved access to care was associated with lower caries experience in children enrolled in Medicaid [17]. It also forms the basis of our recommendation to increase this access in Saudi Arabia by addressing barriers that may deter families from seeking care in public clinics such as long waiting lists.

In our study, the prevalence of twice a day brushing using fluoridated toothpaste was 68%. This was higher than the international global level (46%) reported among schoolchildren in 15 countries in 2014 [18] and significantly less than an American study conducted in Chicago which reported that 83% of children brushed twice a day [19]. It was lower than the frequency of tooth brushing among Saudi children reported in a previous study (82%) [10]. Tooth brushing was significantly associated with lower odds of caries presence in univariate regression but lost significance when other preventive methods were considered. This should not be interpreted to mean that this self-care oral hygiene practice has minimal importance. Rather, it implies that tooth brushing – being the most prevalent among the preventive methods – might have been less likely to differentiate between children based on their caries status. In addition, because of regular dental checkups (introduced in the multivariable model), the children might have been exposed to other fluoride vehicles such as professionally applied fluorides that might share in the preventive effect of fluoridated toothpaste. This would make it difficult to attribute to one fluoride source a major caries preventive role or for it to retain statistical significance [20]. This is particularly relevant in Saudi Arabia where the use of bottled water is very common with generally optimal fluoride level [21].

The low prevalence of fissure sealants in our study agrees with that reported by Al Agili et al. [9] where 9% of primary schoolchildren from Jeddah, Saudi Arabia had sealant. The preventive effect of fissure sealant has been documented by researchers [22] including systematic reviews [8]. In the present study, the presence of fissure sealants was significantly associated with less caries in univariate regression but not

when other preventive methods were considered in multi-variable regression. At the mean age of the children in the current study, the presence of sealant would protect against caries of the four first permanent molars. The eight primary molars present in this age do not usually receive sealant protection. In multivariable regression, this lower impact of sealant on caries presence on the combined 12 molars would be superseded by the effect of regular dental visits and brushing which act on all present teeth.

The significant association of regular dental checkups with less caries presence found in our study agrees with a previous longitudinal study which concluded that there was a positive effect of office-based preventive programs on dmft scores [23]. Children who irregularly visit the dentist are more likely than others to develop dental caries [24].

Our study added to the existing literature showing the effectiveness of fluoride and pit and fissures sealant in caries presence/absence [25,26] and further compared them with regular dental checkups. A point of strength in this study was the number of children included, which allowed for greater precision of estimates. In addition, our study covered several areas in the Eastern Province of Saudi Arabia, which increases the generalizability of our findings. The study, however, has some limitations. Because it was cross-sectional, causality could not be confirmed and future longitudinal studies in the same or similar setting are recommended. Parents, who are liable to recall bias, provided information about several factors and it would be useful to conduct future studies using verifiable data obtained from records or other sources. A further limitation was that some factors which are known to be associated with caries, such as dietary factors and socioeconomic background, were not included and their confounding effect could not therefore be controlled.

Our results can be generalized to children with backgrounds similar to those included in our study; those with moderate level of health insurance coverage and in settings where most children brush but only few have pit and fissure sealant. The Eastern Province is an oil-producing region, with a population of 4.1 million, 1.2 million of whom are foreigners. This can reflect on the socioeconomic status that mostly ranges from mid-level to high [27]. In other groups with different socio-economic backgrounds, or in other parts of the country, evidence is needed to support if our findings would still apply since ability to access care and visit the dentist regularly may be affected.

Disclosure statement

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References

- [1] Kumar S, Tadakamadla J, Kroon J, et al. Impact of parent-related factors on dental caries in the permanent dentition of 6–12-year-old children: a systematic review. *J Dent*. 2016;46:1–11.
- [2] Askelson NM, Chi DL, Momany ET, et al. The importance of efficacy: using the extended parallel process model to examine factors related to preschool-age children enrolled in medicaid receiving preventive dental visits. *Health Educ Behav*. 2015;42:805–813.
- [3] Deljo E, Sijercic Z, Mulaosmanovic A, et al. Economic importance of the preventive measures in dentistry. *Mater Sociomed*. 2016;28:397–401.
- [4] Goldman AS, Chen X, Fan M, et al. Methods and preliminary findings of a cost-effectiveness study of glass-ionomer-based and composite resin sealant materials after 2yr. *Eur J Oral Sci*. 2014;122:230–237.
- [5] Folayan MO, Kolawole KA, Chukwumah NM, et al. Use of caries prevention tools and associated caries risk in a suburban population of children in Nigeria. *Eur Arch Paediatr Dent*. 2016;17:187–193.
- [6] Kumar S, Tadakamadia J, Durauswamy P, et al. Dental caries and its socio-behavioral predictors – an exploratory cross-sectional study. *J Clin Pediatr Dent*. 2016;40:186–192.
- [7] Elidrissi SM, Naidoo S. Prevalence of dental caries and toothbrushing habits among preschool children in Khartoum State, Sudan. *Int Dent J*. 2016;66:215–220.
- [8] Wright J, Tampi M, Graham L, et al. Sealants for preventing and arresting pit-and-fissure occlusal caries in primary and permanent molars; a systematic review. *J Am Dent Assoc*. 2016;147:631–645.
- [9] Al Agili D, Niazy H, Pass M. Prevalence and socioeconomic determinants of dental sealant use among schoolchildren in Saudi Arabia. *East Mediterr Health J*. 2012;18:1209–1216.
- [10] Farooqi F, Khabeer A, Moheet I, et al. Prevalence of dental caries in primary and permanent teeth and its relation with tooth brushing habits among schoolchildren in Eastern Saudi Arabia. *Saudi Med J*. 2015;36:737–742.
- [11] Al-Jaber A, Da'Ar OB. Primary health care centers, extent of challenges and demand for oral health care in Riyadh, Saudi Arabia. *BMC Health Serv Res*. 2016;16:628.
- [12] Alshahrani A, Raheel S. Health care system and accessibility of dental services in Kingdom of Saudi Arabia: an update. *J Int Oral Health*. 2016;8:883–887.
- [13] Al Agili D. A systematic review of population-based dental caries studies among children in Saudi Arabia. *Saudi Dent J*. 2013;25:3–11.
- [14] Widström E, Eaton K, Borutta A, et al. Oral healthcare in transition in Eastern Europe. *Br Dent J*. 2001;190:580–584.
- [15] Association of state and territorial dental directors Basic Screening Surveys: an approach to monitoring community oral health [Internet]. 1999 [cited 2008]. Available from: <https://dphhs.mt.gov/Portals/85/publichealth/documents/OralHealth/BSSChildrensManual2008.pdf>
- [16] Almalki M, Fitzgerald G, Clark M. Health care system in Saudi Arabia: an overview. *East Mediterr Health J*. 2011;10:784–793.
- [17] Kranz AM, Rozier RG, Preisser JS, et al. Examining continuity of care for Medicaid-enrolled children receiving oral health services in medical offices. *Matern Child Health J*. 2014;19:196–203.
- [18] Llodra JC, Phantumvanit P, Bourgeois DM, et al. LLL2: an international global level questionnaire on toothbrushing and use of fluoride toothpaste. *Int Dent J*. 2014;64(Suppl. 2):20–26.

- [19] Polk D, Geng M, Levy S, et al. Frequency of daily tooth brushing: predictors of change in 9- to 11-year old US children. *Commun Dent Health*. 2014;31:136–140.
- [20] Carey CM. Focus on Fluorides: update on the use of fluoride for the prevention of dental caries. *J Evid Based Dent Pract*. 2014;14:95–102.
- [21] Aldrees AM, Al-Manea SM. Fluoride content of bottled drinking waters available in Riyadh, Saudi Arabia. *Saudi Dent J*. 2010;22:189–193.
- [22] Tikhonova S. Sealing pits and fissures of permanent molars in children and adolescents is effective in controlling dental caries. *J Am Dent Assoc*. 2015;146:409–411.
- [23] Achembong LN, Kranz AM, Rozier RG. Office-based preventive dental program and statewide trends in dental caries. *Pediatrics*. 2014;133:e827–e834.
- [24] Carrillo-Diaz M, Crego A, Armfield JM, et al. Dental fear-related cognitive vulnerability perceptions, dental prevention beliefs, dental visiting, and caries: a cross-sectional study in Madrid (Spain). *Commun Dent Oral Epidemiol*. 2015;43:375–384.
- [25] Hiiri A, Ahovuo-Saloranta A, Nordblad A, et al. Pit and fissure sealants versus fluoride varnishes for preventing dental decay in children and adolescents. *Cochrane Database Sys Rev*. 2010;3:CD003067.
- [26] Deery C. Fissure seal or fluoride varnish? *Evid Based Dent*. 2016;17:77–78.
- [27] Arab News. Riyadh most populous Saudi city, Makkah most populous province; 2012. [Internet]. Available from: <http://www.arabnews.com/node/407209>