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· 防治实践 ·

广州市海珠区儿童第一恒磨牙窝沟封闭3年后 效果评价

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【摘要】 目的 探讨广州市海珠区儿童第一恒磨牙免费窝沟封闭项目(2019)实施3年后的防龋效果,为今后儿童第一恒磨牙窝沟封闭项目的开展和儿童恒牙龋的有效防治提供参考。**方法** 2022年10月,采用随机抽样的方法抽取2019年接受广州市海珠区儿童第一恒磨牙免费窝沟封闭项目的270名广州市海珠区六年级小学生作为封闭组,将符合窝沟封闭条件而没有接受窝沟封闭的同年龄223名小学生作为对照组,检查以上2组学生的第一恒磨牙,封闭组记录第一恒磨牙封闭剂保留情况和患龋情况,对照组记录第一恒磨牙患龋情况,并与2011年海珠区窝沟封闭项目实施3年后的效果相比较。**结果** 封闭组与对照组相比,患龋率下降(15.56% vs. 21.52%, $P > 0.05$),龋齿检出率显著降低(6.12% vs. 9.00%, $P < 0.001$),龋均显著下降(0.19 vs. 0.37, $P < 0.001$)。相较于2011年海珠区窝沟封闭项目3年后效果:2014年第一恒磨牙封闭剂保留率65.56%,完好率42.25%;第一恒磨牙保护率38.34%;2019年海珠区窝沟封闭项目3年后效果提升:2022年第一恒磨牙封闭剂保留率86.09% ($P < 0.001$),完好率47.00% ($P < 0.001$);第一恒磨牙保护率51.97%。**结论** 2019年广州市海珠区儿童第一恒磨牙窝沟封闭项目的质量较好,降低了龋齿检出率,封闭剂保留率保持在较高水准,但完好率仍未过半,仍需在各年龄段大力推广口腔健康教育及检查,重视窝沟封闭复查和重封闭工作。

【关键词】 第一恒磨牙; 窝沟封闭; 龋病; 患龋率; 龋均; 抽样调查; 口腔流行病学

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Effectiveness evaluation of pit and fissure sealing for first permanent molars in children in Haizhu District, Guangzhou after 3 years CHEN Chunyan, TAN Fengqing, YANG Yan, LIU Xia. Guangzhou Haizhu District Hospital of Stomatology, Guangzhou 510220, China

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【Abstract】 Objective To investigate the effect of a free pit and fissure sealing program for caries prevention on first permanent molars (six-year molars) in Haizhu District, Guangzhou, three years after its implementation in 2019. The study aims to provide a reference for the future development of pit and fissure sealing programs for children's first permanent molars and the effective prevention and treatment of permanent tooth caries in children. **Methods** A random sampling method was used. In 2022 October, 270 sixth-grade primary-school students in Haizhu District, Guangzhou, who had participated in the free pit and fissure sealing program for their first permanent molars in 2019, were placed in the sealant group. Another 223 age-matched students from the same schools who met the criteria for the pit and fissure sealing but did not participate in the program were placed in the control group. The first permanent molars of students in both groups were examined. The retention status of the sealant and the caries status of the first permanent molars were recorded for the sealant group, and the caries status of the first permanent molars was recorded for the control group. The 2022 results were compared with the results of a prior pit and fissure sealing program implemented in Haizhu District in 2011, three years after its implementation. **Results** Compared with the control group, the caries rate

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in the sealant group decreased (15.56% vs. 21.52%, $P > 0.05$), the caries detection rate was significantly lower (6.12% vs. 9.00%, $P < 0.001$), and the mean number of decayed teeth was significantly reduced (0.19 vs. 0.37, $P < 0.001$). Compared with the results of the pit and fissure sealing program in Haizhu District in 2011 (in 2014, the retention rate of the first permanent molar sealant was 65.56%, the intact rate was 42.25%, and the protection rate was 38.34%), the results of the pit and fissure sealing program in Haizhu District in 2019 [in 2022, the retention rate of the first permanent molar sealant was 86.09% ($P < 0.001$), the intact rate was 47.00% ($P < 0.001$), and the protection rate was 51.97%] were improved. **Conclusion** The quality of the pit and fissure sealing program for the first permanent molars in Haizhu District, Guangzhou in 2019 was good. It reduced the caries detection rate, and the retention rate of the sealant was maintained at a high level. However, the intact rate was less than 50%; therefore, it is necessary to vigorously promote oral-health education and examinations in all age groups, and to be attentive to the re-examination and re-sealing of fissure sealants.

【Key words】 first permanent molar; pit and fissure sealing; caries; caries rate; mean caries index; sampling survey; oral epidemiology

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【Competing interests】 The authors declare no competing interests.

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2022年广州市第三次儿童口腔健康流行病学调查结果显示:广州市12岁儿童恒牙患龋率达47.63%(海珠区为43.12%),龋坏最好发牙位为第一恒磨牙^[1]。窝沟封闭是指不损伤牙体组织,将封闭材料涂布于牙齿各个面的窝沟点隙,以预防窝沟龋的方法。该方法是目前世界卫生组织推荐的窝沟龋主要干预措施。2022年10月,广州市海珠区口腔医院组织调查组,对海珠区儿童第一恒磨牙免费窝沟封闭项目实施3年后的防龋效果进行追踪评估,现将结果报道如下,以期更为有效地降低儿童第一恒磨牙患龋率提供参考。

1 资料和方法

1.1 对象

广州市海珠区小学六年级学生(2022年10月调查时)。

封闭组:2018年秋季注册且接受第一恒磨牙免费窝沟封闭的二年级学生(2019年实施窝沟封闭)。对照组:经检查符合窝沟封闭条件而没有进行窝沟封闭的同学、同年龄、同性别的同年级学生。

1.2 抽样方法

1.2.1 样本量估计 流行病学调查遵循经济、有效的原则,采用多阶段、分层、等容量、随机抽样的方法,根据样本量公式 $n = \frac{\mu_{\alpha/2}^2 p (1-p)}{\delta^2}$ 进行估算,估算率 p 按照12岁儿童恒牙患龋率18.76%(2014年广州市儿童窝沟封闭项目流调结果)^[2] 检验水准 α 为双侧0.05, $\mu_{\alpha/2} = 1.96$, 抽样误差 δ 假设为20% p , 计

算得出理论样本量为416,为保证足够的样本量,抽样时每个调查点根据情况增加20%的样本量,最终12岁儿童窝沟封闭学生检查人数为493名。

1.2.2 样本采集 海珠区随机抽取赤岗街、素社街、南华西街、昌岗街4条街道,以上街道各抽取2所小学,选取在校六年级学生共493人,分为封闭组(270人)和对照组(223人),纵向观察实施窝沟封闭3年后封闭组第一恒磨牙封闭剂保留情况、患龋情况;对比组间的患龋率和龋均,分析窝沟封闭对第一恒磨牙的保护效果。

1.3 检查人员及标准

此次追踪调查按照《第四次全国口腔健康流行病学抽样调查方案》临床检查和质量控制要求执行。①检查人员均为从事口腔临床工作3年以上的口腔内科医生,经广州市窝沟封闭项目技术指导组培训合格,并通过检查标准一致性检验, Kappa 值达到0.95。②检查器械为统一提供的检查材料包和社区牙周指数(communitary periodontal index, CPI)探针等器械,并要保证现场环境符合口腔检查要求,在人工光源下以视诊结合探诊的方式依次检查16、26、36、46四颗第一恒磨牙。封闭组检查第一恒磨牙封闭剂保留情况和患龋情况,对照组检查第一恒磨牙患龋情况。③口腔检查表的核查由市级项目办专人负责;数据录入采用双录入法,在录入过程中和录入完成后对数据进行核对校正。

1.4 统计学分析

使用SPSS 25.0进行统计分析,卡方检验比较第一恒磨牙封闭剂完好率、部分保留率、患龋率、

龋齿检出率;若样本满足正态分布且方差齐性时,采用 t 检验分析比较龋均,检验水准双侧 $\alpha=0.05$ 。计算第一恒磨牙保护率[第一恒磨牙保护率=(对照组龋齿检出率-封闭组龋齿检出率)/对照组龋齿检出率 $\times 100\%$]。

2 结果

2.1 第一恒磨牙封闭剂保留情况

2.1.1 2022年数据 本次调查随机抽取海珠区493名六年级学生1 478颗第一恒磨牙,其中封闭组270人(54.77%);对照组223人(45.23%);男生269人

(54.56%);女生224人(45.44%);封闭组834颗第一恒磨牙,封闭剂保留率为86.09%,其中完好率为47.00%,部分保留率为39.09%,完全脱落率为13.91%。封闭组中,男生封闭剂保留率(87.66%)高于女生(84.14%),但差异无统计学意义($\chi^2=2.14, P=0.141$)(表1)。

2.1.2 2022与2014年数据比较 2022年海珠区六年级学生第一恒磨牙封闭剂保留率为86.09%,高于2014年的65.56%^[1];部分保留率为39.09%,高于2014年的23.31%^[1];完好率为47.00%,高于2014年的42.25%^[1],差异均具有统计学意义($P<0.05$)(表2)。

表1 2022年海珠区六年级学生第一恒磨牙窝沟封闭效果评估

Table 1 Effectiveness evaluation of pit and fissure sealing for first permanent molars in six-grade students in Haizhu District in 2022 n (%)

Gender	N	n	Retention status			Shedding teeth
			Intact teeth	Partially retained teeth	Total	
Male	149	462	227 (49.13)	178 (38.53)	405 (87.66)	57 (12.34)
Female	121	372	165 (44.35)	148 (39.78)	313 (84.14)	59 (15.86)
Total	270	834	392 (47.00)	326 (39.09)	718 (86.09)	116 (13.91)
χ^2			2.790	1.030	2.140	
P			0.095	0.311	0.141	

N: number of people examined. n: number of teeth examined

表2 2022年与2014年海珠区六年级学生第一恒磨牙窝沟封闭效果评估情况比较

Table 2 Comparison of the effectiveness of pit and fissure sealing for first permanent molars in six-grade students in Haizhu District in 2022 and 2014 n (%)

Year	N	n	Retention status			Shedding teeth
			Intact teeth	Partially retained teeth	Total	
2022	270	834	392 (47.00)	326 (39.09)	718 (86.09)	116 (13.91)
2014 ^[1]	562	1 832	774 (42.25)	427 (23.31)	1 201 (65.56)	631 (34.44)
χ^2			5.262	70.421	119.871	
P			0.022	0.001	0.001	

N: number of people examined. n: number of teeth examined

2.2 第一恒磨牙防龋效果分析

2.2.1 2022年数据 本次调查对海珠区493名六年级学生的1 478颗第一恒磨牙进行检查,总体患龋率为18.26%(90/493),龋齿检出率为9.00%(133/1 478),龋均为0.27(133/493)。

封闭组270名学生834颗第一恒磨牙,有42人共51颗牙患龋,患龋率为15.56%(42/270),龋齿检出率为6.12%(51/834),龋均为0.19(51/270);对照组223名学生644颗第一恒磨牙,患龋率为21.52%(48/223),龋均为0.37(82/223),龋齿检出率为12.73%(82/644)。

封闭组和对照组对比,第一恒磨牙患龋率降低,但差异无统计学意义($\chi^2=2.92, P=0.081$),龋齿检出率显著降低($\chi^2=19.44, P<0.001$),龋均显著降低($t=-2.86, P<0.001$)(表3)。

2.2.2 2022年与2014年数据比较 本次调查封闭组第一恒磨牙患龋率、龋齿检出率和龋均与2014年封闭组患龋率(15.56% vs. 13.70%)、龋齿检出率(6.12% vs. 5.51%)和龋均(0.19 vs. 0.18)差异无统计学意义;在对照组,本次调查学生患龋率(21.52% vs. 19.51%)和龋均略高于2014年(0.37 vs. 0.30),而龋齿检出率较2014年(12.73% vs. 8.93%)有显著升

表3 2022年海珠区六年级学生封闭组和对照组第一恒磨牙患龋情况
Table 3 Dental caries status of first permanent molars in sealed and control groups among sixth-grade students in Haizhu District in 2022

Gender	Group	N	n	Caries patients	Caries teeth	Mean caries index
Male	Sealed	149	462	19 (12.75)	24 (5.19)	0.16
	Unsealed	120	362	26 (21.67)	41 (11.33)	0.34
Female	Sealed	121	372	23 (19.01)	27 (7.26)	0.22
	Unsealed	103	282	22 (21.36)	41 (14.54)	0.40
Total	Sealed	270	834	42 (15.56)	51 (6.12)	0.19
	Unsealed	223	644	48 (21.52)	82 (12.73)	0.37
	Total	493	1 478	90 (18.26)	133 (9.00)	0.27
χ^2/t				2.92	19.44	2.86
P				0.081	< 0.001	< 0.001

N: number of people examined. n: number of teeth examined. Mean caries index: number of caries teeth/number of people examined

高($P < 0.001$)(表4)。

2.3 窝沟封闭效果比较分析

本次调查结果显示,窝沟封闭3年对第一恒磨牙的保护率为51.97%,相较于2014年的38.34%^[1]

有提高。封闭组第一恒磨牙患龋率较对照组的下降比例为27.73%,相较于2014年^[1]的29.78%基本持平;封闭组第一恒磨牙龋均较对照组的下降比例为48.63%,相较于2014年的39.60%有提高(图1)。

表4 2022年与2014年海珠区六年级学生封闭组和对照组第一恒磨牙患龋情况比较
Table 4 Comparison of dental caries status of first permanent molars in sealed and control groups among sixth-grade students in Haizhu District in 2014 and 2022

Year	Group	N	n	Caries patients	Caries teeth	Mean caries index
2022	Sealed	270	834	42 (15.56)	51 (6.12)	0.19
	Unsealed	223	644	48 (21.52)	82 (12.73)	0.37
2014	Sealed	562	1 834	77 (13.70)	101 (5.51)	0.18
	Unsealed	410	1 366	80 (19.51)	122 (8.93)	0.30
χ^2/t	Sealed			0.51	0.39	0.14
P	Sealed			0.472	0.531	0.937
χ^2/t	Unsealed			0.36	6.94	0.17
P	Unsealed			0.550	0.001	0.844

N: number of people examined. n: number of teeth examined. Mean caries index: number of caries teeth/number of people examined

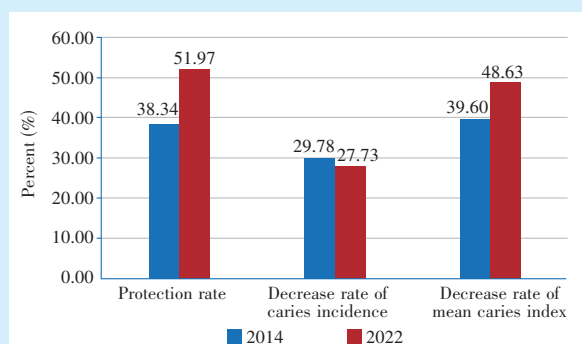


Figure 1 Comparison of caries prevention effectiveness of pit and fissure sealing for first permanent molars among sixth-grade students in Haizhu District in 2022 and 2014

图1 2022年与2014年海珠区六年级学生第一恒磨牙窝沟封闭防龋效果比较

3 讨论

为有效预防控制儿童龋病的发生,促进儿童身心健康,广州市政府自2011年^[3]起将广州市儿

童第一恒磨牙免费窝沟封闭项目列入广州市深化医药卫生体制改革重大公共卫生项目,市财政下拨专项经费,免费为广州市7~8岁适龄儿童开展

第一恒磨牙窝沟封闭预防龋齿服务。2014年^[2],为了解广州市儿童第一恒磨牙免费窝沟封闭项目开展2~3年后10~12岁儿童口腔健康行为状况,为今后制定口腔健康工作重点提供信息支持,广州市对2011—2012年全市儿童第一恒磨牙免费窝沟封闭项目实施了第一次全面、系统的评估,结果显示,广州市71.50%的10~12岁儿童接受过窝沟封闭预防龋齿治疗,窝沟封闭对适龄儿童第一恒磨牙防龋效果显著,窝沟封闭组窝沟封闭2年及3年后患龋率均低于对照组。2022年,本机构对海珠区儿童第一恒磨牙免费窝沟封闭项目(2019)实施3年后的防龋效果进行了追踪评估,结果显示:广州市海珠区儿童第一恒磨牙免费窝沟封闭项目的质量较好,窝沟封闭实施3年后封闭剂保留率为86.09%,第一恒磨牙保护率为51.97%,均高于全市平均水平。相较于2014年第一恒磨牙的封闭剂保留率(65.56%)和保护率(38.34%),本次调查相应指标均有提高,窝沟封闭质量保持稳步上升趋势。根据广州市第三次儿童口腔健康流行病学调查结果:海珠区12岁儿童恒牙龋均为1.09,低于广州市1.24的龋均水平^[1],在WHO龋病流行程度的评价标准^[4]中属于“很低”级别,但患龋率仍达到43.12%,这可能是因为12岁恒牙龋患人群中,发生1颗牙齿龋坏的人数是最多的,龋坏恒牙数量不多而患龋儿童基数较大。患龋儿童中61.72%的恒牙龋发生在第一恒磨牙,因此,对第一恒磨牙进行窝沟封闭仍具有针对性和必要性。

本次调查中海珠区儿童第一恒磨牙患龋率为18.26%,低于马德里^[5]、沙特阿拉伯^[6]和新加坡^[7]等地同龄人,但封闭剂完好率(47.00%)仍未过半。封闭剂是否保留完好关系到能否取得预期的防龋效果^[8],封闭剂保留率的高低可侧面反映防龋效果的好坏。为了提高封闭剂的保留率,近年来关于新型窝沟封闭材料及方法的研究越来越多,例如光致变色释氟性窝沟封闭剂^[9],精氨酸改性后的窝沟封闭剂^[10]等。新型封闭剂氟释放性能和抗菌性能均有明显增强,且相比之前的封闭剂更加结实稳定,不易脱落^[11]。除了新型窝沟封闭剂之外,在釉质表面的预处理方面也有一些研究,例如喷砂联合流动树脂^[12]窝沟封闭有效提高封闭剂的保留率,Nd: YAP激光^[13]处理釉质表面可改善窝沟封闭剂与釉质表面的粘接强度,且在牙齿处理过程中不产生疼痛、震动或过度发热,也无需严格隔湿。虽然窝沟封闭操作技术和材料方面都不断有新的

研究出现,然而,作为一项公共卫生服务项目,需要综合考量操作可行性、成本效益和远期效果^[14],具有高质量的长期临床研究验证窝沟封闭剂的保留率和龋降低率才能为临床治疗选择提供最强的证据。严格把握窝沟封闭术的适应证、保证操作过程规范化及针对个体特征设计个性化的窝沟封闭方案亦是提高窝沟封闭术成功率的重点^[15]。

2015年—2016年广东省12~15岁人群恒牙龋病抽样调查结果显示^[16],广东省12岁儿童患龋水平呈快速增长趋势,本次调查结果也显示海珠区6年级学生第一恒磨牙患龋率呈现上升趋势。儿童患龋水平上升与饮食精细化以及含糖食品摄入增多的大背景相关^[17],与此同时,儿童龋病发生与其口腔健康行为^[18]密切相关,例如饮食^[19]、刷牙、营养^[20]、遗传^[21]、氟化物的使用^[22]等等。Orfali等^[6]评估了沙特阿拉伯学龄儿童恒磨牙窝沟龋潜在患病率、程度和相关因素,结果提示:口腔健康状况自我护理、高糖饮食以及牙科治疗等方面因素是龋齿发生的影响因素。还有研究指出,儿童每日消耗超加工肉类、快餐和方便面的频率、克数和热量与龋齿的发生密切相关^[23]。Buzatu等^[22]筛选了2013—2023年在全球各地区进行的维生素D水平与青少年恒牙龋齿发病率之间的关系研究,分析显示,维生素D不足在研究人群中普遍存在,而关于维生素D状态和龋齿风险之间的关系,结论则不尽相同,这可能与研究方法和地理环境的差异有关。也有报道倾向于表示改善维生素D状态可能是儿童和青少年龋齿预防策略的有益组成部分^[24],值得进一步研究。Ha等^[25]通过窝沟封闭临床对照试验得出结论:喜食甜食、含糖饮料是儿童发生龋齿的独立危险因素,对儿童采取窝沟封闭术可有效预防龋齿发生,且能够降低龋齿程度,对牙釉质产生保护作用,这与Lakshmanan等^[26]的研究结果一致。目前应用的窝沟封闭剂通常含氟,因此在其封闭后逐渐溶解并释放出氟离子,Priscilla等^[15]研究也指出,封闭剂所释放的氟离子具有矿化作用,能够提高牙齿稳定性。然而随着时间推移,封闭剂可能出现不断脱落的情况,导致龋齿发生率有一定程度增加。因此,需重视窝沟封闭复查和重封闭工作,若发现封闭剂有部分或完全脱落的情况发生,需进行重新封闭。受新冠肺炎疫情所影响,2020年广州城区窝沟封闭复查率明显下降^[27],2021年有回升,但仍不及2018和2019年。

广州市第三次儿童口腔健康流行病学调查数

据显示,广州市12岁儿童每天至少一次进食含糖食品(甜点、糖果、淀粉零食、饮料等)占比超三成^[1]。超过半数儿童未能掌握正确的刷牙方法,刷牙时长不到1 min,逾六成儿童不清楚自己使用的牙膏是否含氟,日常使用牙线的学生不到一成。此外,本次调查期间,因疫情影响,儿童长期居家,家长看管缺失,居家期间含糖食品容易获取,而刷牙等口腔卫生行为未能执行到位,上述因素综合作用,导致儿童患龋风险增高。此外,人们越来越认识到,龋齿与心理^[28]、行为^[29]、经济条件^[30]、社会环境^[31]等因素均存在一定联系。较好的经济地位、积极的社交行为、获得更多的社会支持对控制龋齿有积极作用。

2022年调查结果显示,广州市12岁儿童恒牙患龋率达47.63%^[1],远高于第四次全国口腔健康流行病学34.5%的调查结果^[3]。

广大医务工作者尤其基层口腔医生需充分重视当前牙防工作的重要性和紧迫性。作为海珠区牙病防治中心的基层工作者,笔者结合基层牙防的工作特点及文献报告,建议:①各单位协同合作,定期开展儿童口腔流行病学调查,监测龋病的变化趋势^[32]。②关口前移、强化儿童龋病源头预防^[33]。充分发挥妇幼机构、社区卫生服务中心、乡镇卫生院等医疗机构作用,将口腔疾病预防关口提前至婚检、孕检以及婴幼儿体检的全过程。开展孕前、孕期及幼儿体检的口腔健康教育,通过示范、图册等展示正确的婴幼儿口腔护理方法,避免养成不良的喂养及口腔习惯。③加强儿童口腔健康宣教^[34],丰富宣教形式和内容,从幼儿园、小学至中学定期开展口腔健康教育课堂,并举办例如刷牙比赛、口腔健康知识竞赛等活动,增强口腔卫生宣教趣味性和参与感,促进儿童建立良好的口腔卫生习惯,校园体检常规加入口腔检查内容,及时向学生和家长反馈检查结果和建议。寒、暑假向家长发放带孩子进行口腔检查的倡议书,强调龋齿的危害、及时治疗的意义等,尽可能做到儿童龋病早发现、早治疗^[35]。④充分联合民营口腔诊疗机构投入到儿童龋病的预防、检查和诊疗工作中。⑤充分发挥网络宣传的便利性和普及性,不断制作短小精良的口腔健康宣教短视频在各个口腔诊疗机构公众号及各大主流视频平台播放,扭转部分家长对于儿童口腔健康的旧观念和认知,增强家长的口腔疾病预防观念,掌握正确的刷牙方法,帮助和督促孩子有效清洁口腔。使用氟化

物,倡导“控糖饮食”的长期理念,从而有效预防儿童龋病^[36]。

窝沟封闭确切的防龋效果经长期多方验证已达成共识,是现有条件下采取的最有效的龋齿预防策略之一,项目组通过参与2014年和2022年广州市两次大规模横断面调查,发现龋齿在人群中的分布不平均现象,有一部分儿童处于无龋状态,有部分儿童的患龋水平较高,国外研究也得出相似结果^[37],因此在未患龋前采用龋风险预测手段识别无龋儿童中的高患龋风险个体,从而有的放矢地开展防治工作,将口腔健康公共卫生资源倾斜于这部分人群,将更加有效地实现龋病的预防和控制。笔者回顾文献多为通过横断面调查来分析龋病相关的危险因素,而想要了解一段时间内新龋增加的程度,需要通过纵向观察收集资料,更能准确反映多种危险因素与龋病发病率之间的关系,进而建立群体龋预测的方法和模型^[38]。本次流调样本量选取略微保守,以后需扩大样本量,开展一些前瞻性的研究,进一步准确了解海珠区儿童的龋病患病水平及原因。综上所述,今后笔者将继续致力于培养高质量的窝沟封闭牙防队伍,优化窝沟封闭流程,抓好窝沟封闭复查、复检和重封闭工作,采取综合措施,切实降低患龋率,提升少年儿童的口腔健康水平。

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