Asian Pac. J. Health Sci., 2014; 1(3): 270-278 ISSN: 2349-0659

Document heading doi: 10.21276/apjhs.2014.1.3.23 Original Article

Influence of Diet and Oral Hygiene Practices On Retention of Fissure Sealant in Rural and Urban Children – An In Vivo Study

Damodhar Kappadi*, **Anup Murthy, Deepesh Prajapati**

[1]Department of Pedodontics and Preventive Dentistry, NIMS Dental College, Jaipur, Rajasthan India
[2]Department of Orthodontics, Hitech Dental College, Bhubaneswar, Orissa, India
[3]Department of Pedodontics and Preventive Dentistry, NIMS Dental College, Jaipur, Rajasthan, India

ABSTRACT

Retention of fissure sealant in deep pits and fissures of molar is the main criteria for successful prevention of occurrence of dental caries. These fissure sealants are subjected to various factors like oral hygiene practices and dietary habit that differs from place to place. So a study was conducted to evaluate and compare the retention rate of the flowable composite resin sealant among the rural and urban school children of Davangere (Karnataka) and correlate with their dietary and oral hygiene practices. 40 children from urban and 40 from rural areas of Davangere with bilateral caries free mandibular first permanent molars were included in the study. A total of 160 selected teeth were sealed with flowable resin (Filtek™ Flow) sealant. Evaluation of sealant retention was performed at 6 and 12 month interval by making tooth replicas with elastomeric impression which were then examined under stereomicroscope. The data was statistically analyzed using Chi square test. The results revealed a significantly higher retention of sealant in urban children compared to their rural counterparts. Improved retention rates were present in vegetarian children than in those consuming mixed diet. No statistically significant results were observed with respect to oral hygiene practices. From this study it was concluded that sealants retention was higher in children living in urban areas than in rural. Retention of sealants was more amongst children consuming vegetarian diet than mixed diet.

Key words: Dietary practices, Flowable composite resin, Oral hygiene practices, Pit and fissure sealant, Urban and rural children.

INTRODUCTION

Dental caries is a microbial disease, affecting the hard and soft tissues of the tooth characterized by demineralization of inorganic substances followed by dissolution of organic matrix. Dental caries results from the interplay of three predominant factors, the host, the micro flora and the diet or substrate. It is a result of demineralization of enamel, dentin and cementum initiated by acids produced by oral bacteria.[1]

**Correspondence*
Dr. Damodar Kappadi
Department of Pedodontics and Preventive Dentistry, NIMS Dental College, Jaipur, India
Email: damu316@gmail.com

'Polarization' of caries is occurring on a worldwide basis, where the prevalence of caries is declining in developed countries, increasing in less-developed countries, and is epidemic in countries with emerging economies.[2] The decline in caries prevalence in developed countries has been associated with a more sensible approach of sugar consumption, improved oral hygiene practices and several preventive programs.[3] However, the side-by-side rise in caries prevalence in developing countries, where most of the population resides in villages,[4] is mainly attributed to the fact that oral health care systems in these countries mostly focus on curative care, where as community based prevention and oral health promotion have not been systematically implemented.

Preventive measures like fluoridated water and topical fluorides have played a great role in decreasing

the amount of smooth surface caries, with least preventive effect on pit-and-fissure caries.[5,6,7] Dental sealants are the most preventive measure against pit-and-fissure caries, and have proved to be effective at not only preventing tooth decay before it starts, but also halting the progress of tooth decay in its earliest stages.[8] Pit and fissure sealants is used to describe a material that is introduced in the occlusal pits and fissures of caries susceptible tooth, forming a micromechanically bonded protective layer cutting access to caries producing bacteria from their sources of nutrients.[9] Various materials which could be used for effective sealing of caries susceptible pits and fissures. The most recent amongst them was the flowable composite, which by the virtue of their increased flowability, had higher retention rates. They could withstand the test of time to stay on the teeth which were subjected to wear by a variety of diet and oral hygiene practices.[10]

Never before has there been such an emphasis on the way we are and what we eat. The general public has become increasingly aware of the link between diet and health. This is a welcome trend for oral health since good dietary practices are fundamental to the successful prevention of a variety of oral conditions including dental caries.[11] From a dental standpoint the physical properties of food like hardness, cohesiveness, viscosity, adhesiveness; geometric properties like particle size and shape may affect the retention of the sealant. [12] The high fibrous, gritty-coarse consistency exerts a mechanical cleansing action on teeth and adversely affects the retention of sealant.[13]

Oral health status of an individual, special groups and general population depends on nutritional status, oral hygiene practices and general health status.[13] Personal oral hygiene measures such as toothbrushing have been postulated to be of enormous benefit to the public's oral health.[15] However, it has been suggested that vigorous toothbrushing also can mechanical abrasion and affect the longevity of the sealant in the oral cavity. Hence the effect of diet and oral hygiene measures on the retention of pit and fissure sealants forms the backbone of the preventive care for the children in early mixed dentition.

The present study was conducted to evaluate the effect of diet and oral hygiene practices on the retention of flowable composite fissure sealants in rural and urban population.

MATERIALS AND METHODS

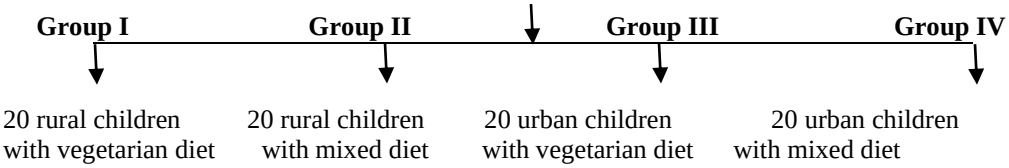
The present *in vivo* study was carried out in the Department of Pediatric and Preventive Dentistry, Bapuji Dental College and Hospital, Davangere, Karnataka, India. Permission for conducting this study was obtained from relevant ethical committee.

40 children from urban and 40 from rural areas of Davangere, aged between 6 – 10 years were selected. A general dental examination of all the children was done prior to the start of the study. Informed written consent was obtained from the parents or guardian of the patients, prior to the start of the study. The dietary practice (type, nature and frequency of diet) and oral hygiene practice (method of cleaning and frequency) of the children were obtained by questionnaire.

The selection criteria included the presence of completely erupted caries free bilateral mandibular first permanent molars with deep, irregular pits and fissures.

Fig 1: Caries free bilateral mandibular 1st permanent molars with deep pits and fissures

A total of 80 children were divided into 4 groups:
80 children (160 mandibular first molars)



Each group will be further divided into 2 subgroups as follows:

A: Children using toothbrush for their oral hygiene practices

B: Children using finger for their oral hygiene practices.

Occlusal surfaces of the teeth were given a prophylaxis with water based slurry of pumice using a short bristle brush. Teeth were then washed thoroughly with water spray. A sharp explorer tip was passed through all pits and fissures to remove pumice (remaining if any). The teeth were washed and dried thoroughly.[10]

Isolation was achieved using rubber dam. Occlusal surfaces of the teeth were etched with 37% phosphoric acid (Scotchbond™ - 3M ESPE) for 30 seconds and rinsed with water. Teeth were then dried with a oil-free air stream to achieve a characteristic frosty white, chalky appearance of enamel.[10]

Fig 2: Isolation – application of rubber dam

Two coats of bonding agent (Adper™ Single Bond 2 - 3M ESPE) was applied using applicator on the etched tooth surface and light cured for 20 seconds using visible light curing unit. A uniform layer of Filtek™ Flow sealant (3M ESPE) was applied on the occlusal surface of the teeth and light cured for 40 seconds. The occlusion was checked using articulating paper and premature contacts were removed.[10]

Fig 3: Application of fissure sealant.

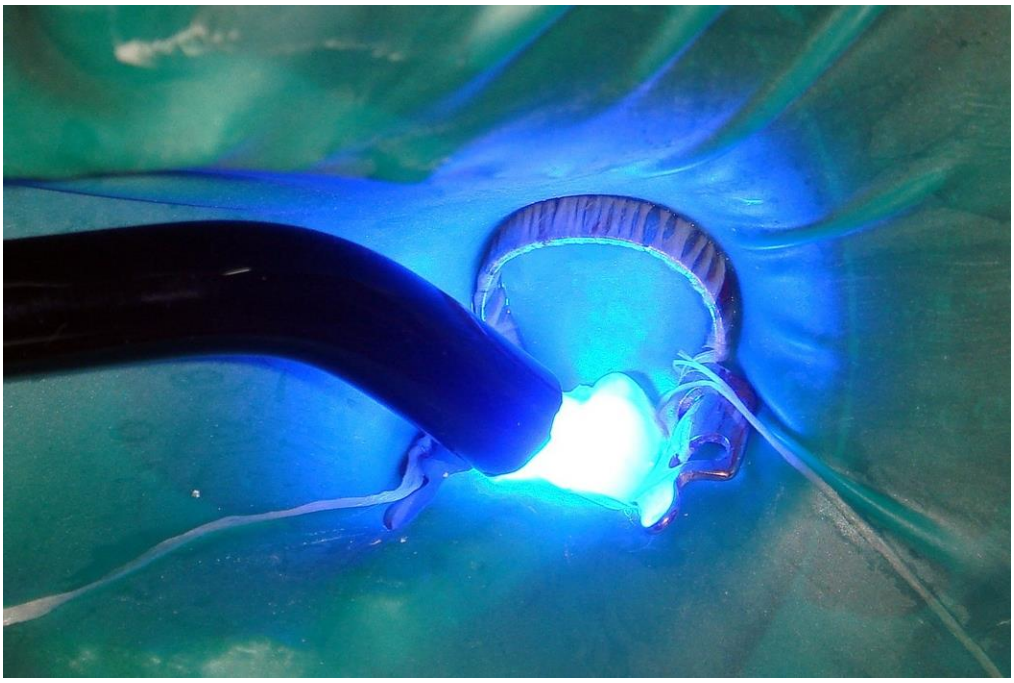


Fig 4: Light curing of applied sealant

Impressions of the sealed bilateral mandibular permanent first molar were made with rubber base impression material (Reprosil® – DENTSPLY Caulk) using custom made acrylic impression trays once in six months for a period of one year. These Impressions were examined under Stereomicroscope and scored using the scoring criteria[16].

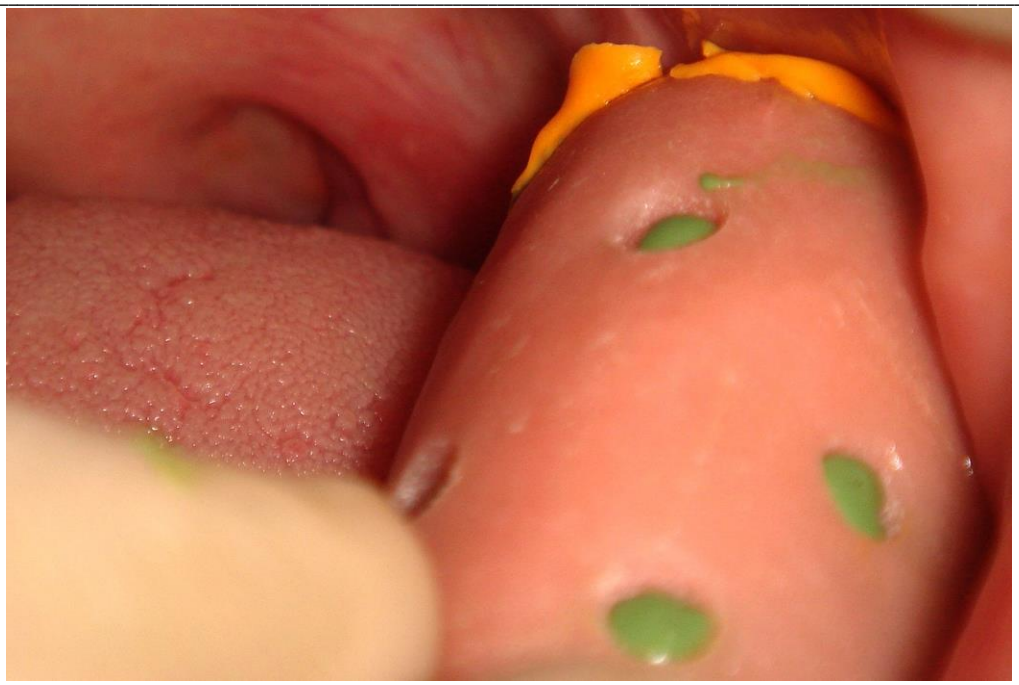
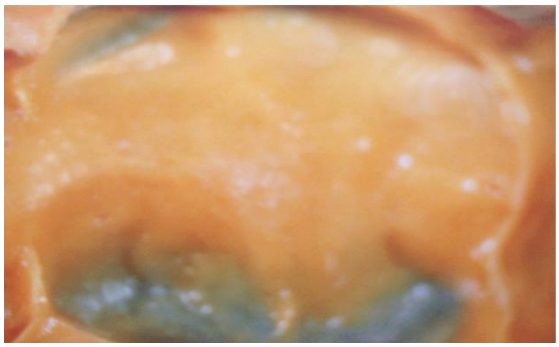
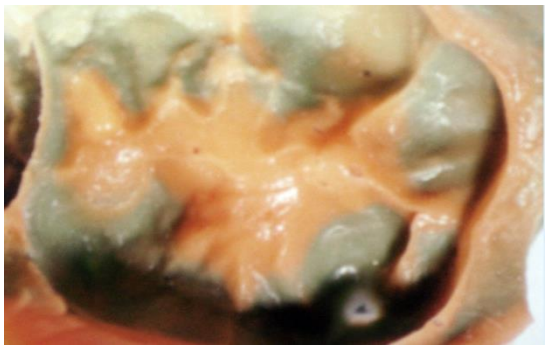


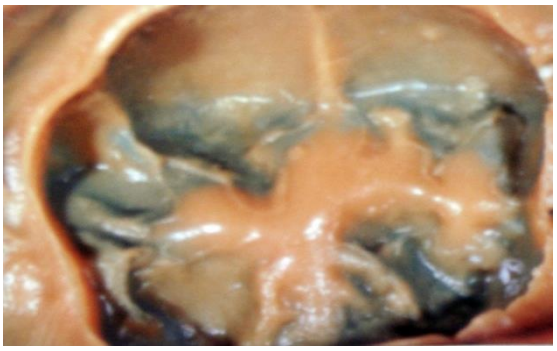
Fig 5: Impression of first permanent molar



Score A



Score B



Score C

Score D

Fig 6: Stereomicroscopic evaluation scores

The data obtained was statistically analyzed by Chi-square test.

Score	Criteria [Mejare I and Mjor IA][16]
A	**Complete extension (retention); sealant covers all parts of the grooves and the fossae**
B	**Absence or loss of sealant restricted to the peripheral part of one or more grooves**
C	**Absence or loss of sealant in one or more grooves including one fossae**
D	**Extensive loss of sealant including grooves and fossae or absence of sealant**

RESULTS

Sealant retention rates of rural and urban children (Table I):

Table I: Comparison of sealant retention in rural and urban children at 6 and 12 month intervals

Time interval	Locality	No.	Retention Scores				Significance
			A	**B**	**C**	**D**	
6 Month	Rural	80	13 (16.3)	30 (37.5)	23 (28.8)	14 (17.5)	$\chi^2 = 14.9$ p = 0.002 [p < 0.05 S]
	Urban	80	25 (31.3)	39 (48.8)	13 (16.3)	3 (3.8)	
12 Month	Rural	80	7 (8.8)	24 (30.0)	26 (32.5)	23 (28.8)	$\chi^2 = 16.4$ p = 0.001 [p < 0.05 S]
	Urban	80	20 (25.0)	27 (33.8)	27 (33.8)	6 (7.5)	

(Numbers in parenthesis are percentage)

S : Significant, NS : Non significant [p < 0.05 S, p > 0.05 NS]

At the end of 6 month in rural children, out of 80 sealed teeth 13 (16.3%) teeth showed score A, 30 (37.5%) teeth showed score B, 23 (28.8%) teeth showed score C and 14 (17.5%) teeth showed score D. Whereas in urban children, 25 (31.3%) teeth showed score A, 39 (48.8%) teeth score B, 13 (16.3%) teeth showed score C and 3 (3.8%) teeth showed score D.At the end of 12 month interval in the rural children, 7 (8.8%) teeth showed score A, 24 (30.0%) teeth showed score B, 26 (32.5%) teeth showed score C and 23 (28.8%) teeth showed score D for sealant retention. Whereas in urban children, 20 (25.0%) teeth showed score A, 27 (33.8%) teeth showed score B, 27 (33.8%) teeth showed score C and 6 (7.5%) teeth showed score D for sealant retention.

6 and 12 month sealant retention rate in urban children was significantly higher than in rural children. ($p<0.05$).

Sealant retention rates of children consuming vegetarian and mixed diet (Table II):

Table II: Comparison of dietary practices on sealant retention at 6 and 12 month intervals

Time interval	Dietary practices	No.	Retention Scores				Significance
			A	**B**	**C**	**D**	
6 Month	Vegetarian	80	25 (31.3)	35 (43.8)	13 (16.3)	7 (8.8)	$\chi^2 = 7.11$ p = 0.06 [p > 0.05 NS]
	Mixed	80	13 (16.3)	34 (42.5)	23 (28.8)	10 (12.5)	

12 Month	Vegetarian	80	18 (22.5)	27 (33.8)	23 (28.8)	12 (15.0)	$\chi^2 = 4.96$ p = 0.18 [p > 0.05 NS]
	Mixed	80	9 (11.3)	24 (30.0)	30 (37.5)	17 (21.3)	

(Numbers in parenthesis are percentage)
S : Significant, NS : Non significant [p < 0.05 S, p > 0.05 NS]

There was no statistically significant difference between the children consuming vegetarian diet and mixed diet at the end of 6 and 12 months. Significantly higher sealant retention was present in urban vegetarian diet children than rural vegetarian diet children.

Sealant retention rates of children using toothbrush and finger for oral hygiene (Table III):

Table III: Comparison of oral hygiene practices on sealant retention at 6 and 12 month intervals

Time interval	Oral hygiene practices	No.	Retention Scores				Significance
			A	**B**	**C**	**D**	
6 Month	Toothbrush	80	20 (25.0)	37 (46.3)	16 (20.0)	7 (8.8)	$\chi^2 = 1.44$ p = 0.70 [p > 0.05 NS]
	Finger	80	18 (22.5)	32 (40.0)	20 (25.0)	10 (12.5)	
12 Month	Toothbrush	80	15 (18.8)	27 (33.8)	25 (31.3)	13 (16.3)	$\chi^2 = 0.99$ p = 0.80 [p > 0.05 NS]
	Finger	80	12 (15.0)	24 (30.0)	28 (35.0)	16 (20.0)	

(Numbers in parenthesis are percentage)
S : Significant, NS : Non significant [p < 0.05 S, p > 0.05 NS]

There was no statistically significant difference between the children using toothbrush and finger for oral hygiene at the end of 6 and 12 months. There was no statistically significant difference between urban and rural children using toothbrush and finger for their oral hygiene practice.

DISCUSSION

India is a large country comprising of more than 100 crore of population. The majority of the population in our country lives in rural areas (72%) however, the dental caries prevalence is higher in the urban areas as compared to the rural areas.[4] These disparities can be attributed to the variations in socioeconomic, diet and oral hygiene.

A preventive intervention for occlusal caries is the fissure sealant, and it has provided the missing link for the theoretical elimination of dental caries.[5,17] The softness of the diet and better oral hygiene care can retain sealants for longer duration, thereby prevention of dental caries being achieved – has conceptual appeal.

The present study was conducted to evaluate the effects of dietary and oral hygiene practices on retention of flowable composite fissure sealant in rural and urban children of Davangere. The study population included a total of 80 children, 40 from rural and 40 from urban areas of Davangere. Children aged between 6 – 10 years were considered because risk of caries attack is highest in the pit and fissure of teeth for the first few years after eruption.[18] The selection criteria included the presence of completely erupted caries free bilateral mandibular first permanent molars with deep, irregular pits and fissures. As the fissures of permanent first molars are usually the first tooth surfaces to become affected by caries in younger age groups.[19]

The occlusal surfaces and fissures of the teeth were cleaned with pumice slurry and short bristle brush to make sure that these areas were free of plaque and debris as it serves to remove plaque, materia alba and calculus which would impede the action and intent of the conditioning solution.[17] Rubber dam isolation of the teeth was performed as rubber dam provides the best and most controllable isolation which is known to influence sealant retention rates.[20] Acid etching was performed using 37% phosphoric acid for 30 sec followed by rinsing with air water spray as acid etching causes a more reactive surface that is more wettable by resins leading to a better sealant penetration.[17] Bonding agent (Adper™ Single Bond 2 – 3M) was used. Studies have confirmed the benefits of bonding agents such as

increased bond strength, reduced Microleakage, enhanced flow of resin into fissures and improved short-term clinical success of sealants.[21]

Flowable composite resin (Filtek™ Flow – 3M) was used as a fissure sealant material. The potential advantage of flowable composite fissure sealant is, its low-viscosity resin provides a higher penetration in deep fissures and presents a lower surface porosity than the conventional resin-based sealant.[22] Thus improved retention can be achieved. Evaluation of the sealant retention was performed at 6 and 12 month interval, as the probability of sealant failure is highest within a year after placement.[17] Tooth replica technique using polyvinyl siloxane impression material can accurately reproduce the relationship between the restoration and tissue and this technique is sufficiently sensitive to discern minor differences in wear resistance among sealants.[23]

The retention rate of sealant in urban children was significantly higher than rural children at both 6 and 12 month intervals. This urban rural disparity can be attributed to variations in the socioeconomic factors, dietary differences and the oral hygiene care.[24] In the urban population due to the higher socio-economic status and rising income there is an increased consumption of refined carbohydrates, but a high dependence on traditional starchy staple food is evident among rural population.[25] The refined carbohydrates food substances consumed by urban population are much softer in consistency and less mastication are required than the much coarse and fibrous food consumed by rural population. These factors can be attributed for a higher retention of sealants in urban population.

The literature regarding the significance of the physical properties of foods and their effect on the retention of pit and fissure sealant is sparse. Some important properties that determine food texture are: mechanical properties like hardness, cohesiveness, viscosity, adhesiveness; geometric properties like particle size and shape; others such as moisture and fat content. From a dental standpoint the physical properties of food may have significance by affecting food retention, food clearance, solubility and oral hygiene inturn affecting the retention of the sealant.[13]

Children who consumed vegetarian diet had a little higher retention rate than those who consumed mixed type of diet. The softer consistency of the vegetarian diet as compared to the gritty-coarse consistency of the mixed diet may explain this phenomenon.[13] The urban children consuming vegetarian diet had a significantly higher retention of sealant than the rural children who consumes vegetarian diet. The high fibrous, cellulose content of plant food consumed in rural population exerts a mechanical cleansing action on teeth and adversely affects the retention of sealant.[13] No significant difference was found in children consuming mixed diet in both the population. This can be attributed to the fact that, the frequency of consumption of non-vegetarian food substances are low and is similar in both urban and rural groups.

No difference in retention of sealant between the children who uses toothbrush and finger for their oral hygiene practices, but there was a better retention in toothbrush users in urban children than their counterpart in rural. Variance noted between the children based on location may also be due to lower level of education regarding oral hygiene and availability and affordability of toothbrushes and fluoridated toothpaste for proper oral health care. Although there is a general agreement that there is lower oral cleanliness in rural children than in urban,[25] a clear cause of oral hygiene practice could not be attributed to the sealant retention. Also statement concerning the effect on sealant retention due to difference in oral cleanliness of various ethnic groups was difficult to formulate since the data was small and not amenable to analysis.

CONCLUSION

Results of the present study should be carefully interpreted, as it tries to correlate various factors that may be attributed to sealant retention. Irrespective of the ambiguities, pit and fissure sealants are one among the best preventive programmes.

REFERENCES

1. Horowitz AM. Introduction to the symposium on minimal intervention techniques for caries. J Public Health Dent 1996;56(3):133-4.
2. Reich E, Lussi A, Newburn E. Caries risk assessment. Int Dent J 1999;49:15-26.
3. Manton DJ, Messer LB. Pit and fissure sealants: another major cornerstone in preventive dentistry. Aust Dent J 1995;40(1):22-9.
4. Damle SG. Epidemiology of dental caries in India. In: Damle SG, editor. Textbook of pediatric dentistry. 3rd ed. New Delhi: Arya publishing house; 2006. p. 77-100.
5. Simonsen RJ. Pit and fissure sealant: theoretical and clinical considerations. In: Braham RL, Morris ME, editor. Textbook of pediatric dentistry. 2nd ed. Delhi: CBS publishers and distributors; 1990. p. 217-34.
6. Mathewson RJ, Primosch RE, Morrison JT. Sealants and preventive resin restoration in children. In: Mathewson RJ, Primosch RE, Morrison JT, editor. Fundamentals of pediatric dentistry. 2nd ed. Chicago: Quintessence; 1987. p. 116-36.
7. Harris NO. Introduction to primary preventive dentistry. In: Harris NO, Garcia-Godoy F, editor. Primary preventive dentistry. 6th ed. New Jersy: Pearson Prentice; 2004:1-22.
8. Association report. J Am Dent Assoc 1997;128:485-8.

9. Simonsen RJ. Pit and fissure sealant: review of literature. Pediatr Dent 2002;24(5):393-414.

10. Corona SAM, Borsatto MC, Garcia L, Ramos RP, Palma-Dibb RG. Randomized, controlled trial comparing the retention of a flowable restorative system with a conentional resin sealant: one-year follow up. Int J Pediatr Dent 2005;15:44-50.

11. Rug-Gunn AJ, Nunn JH. Preface. In: Rug-Gunn AJ, Nunn JH, editor. Nutrition diet and oral health. 1st ed. New York: Oxford University Press; 1999.

12. Klein H, Knutson JW. Studies on dental caries XIII. Effect of ammoniacal silver nitrate on caries in the first permanent molar. J Am Dent Assoc 1942;29:1420-6. Quoted by Simonsen RJ. Pit and fissure sealant: review of literature. Pediatr Dent 2002;24(5):393-414.

13. Nikiforuk G. Nutrition, diet and dental caries. In: Nikiforuk G, editor. Understanding dental caries-etiology and mechanisms basic and clinical aspects. 1st ed. Basel: Karger; 1985. p.182-207 (Vol 1).

14. Mumghamba EGS, Manji KP, Michael J. Oral hygiene practices, periodontal conditions, dentition status and self reported bad mouth breath among young mothers, Tanzania. Int J Dent Hygiene 2006;4:166-73.

15. Hujoel PP, Cunha-Curz J, Loesche WJ, Robertson PB. Personal oral hygiene and chronic periodontitis: a systematic review. Periodontol 2000 2005;37:29-34.

16. Mejare I, Mjor IA. Glass ionomer and resin-based fissure sealants: a clinical study. Scand J Dent Res 1990;98:345-50.

17. Locker D, Jokovic A, Jay EJ. Prevention. Part 8: the use of pit and fissure sealants in preventing caries in the permanent dentition of children. Br Dent J 2003;195(7):375-8.

18. Forss H, Saarni UM, Seppa L. Comparison of glass-ionomer and resin-based fissure sealants: a 2-year clinical trial. Community Dent Oral Epidemiol 1994;22:21-4.

19. Songpaisan Y, bratthall D, Phantumvanit P, Somridhivej Y. Effects of glass ionomer cement, resin-based pit and fissure sealant and HF applications on occlusal caries in a developing country field trial. Community Dent Oral Epidemiol 1995;23:25-9.

20. Eidelman E, Fuks AB, Chosack A. The retetntion of fissure sealants: rubber dam or cotton rolls in a private practice. J Dent Child 1983;50:259-61.

21. Feigal RJ, Hitt J, Splieth C. Retaining sealant on salivary contaminated enamel. J Am Dent Assoc 1993;124:88-96.

22. Gillet D, Nancy J, Dupuis V, Dorignac G. Microleakage and penetration depth of three types of materials in fissure sealant: self-etching primer vs etching: an in vitro study. J Clin Pediatr Dent 2002;26(2):175-8.

23. Gwinnett AJ. The adaptation of visible light cured calcium hydroxide liner to dentin. Quintessence Int 1988;19(2):111-5.

24. Yee R, David J, Khadka R. Oral cleanliness of 12-13 year-old and 15-year-old school children of Sunsari district, Nepal. J Indian Soc Pedod Prev Dent 2006;24:146-51.

25. Addo-Yobo C, Williams SA, Curzon MEJ. Dental caries experience among 12-tear-old urban and rural schoolchildren. Caries Res 1991;25:311-4.

Source of Support: NIL
Conflict of Interest: None