

Practice of Sealants and Preventive Resin Restorations Among Malaysian Dentists

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Purpose: To assess the knowledge, attitude and utilisation regarding fissure sealants (FS) and preventive resin restorations (PRR) among Malaysian dentists.

Materials and Methods: A questionnaire consisting of 35 questions was distributed by mail or an online survey to 425 registered dentists selected according to place of work by stratified random sampling.

Results: One hundred fifty-three dentists responded to the survey. A positive attitude towards FS and PRR was noted among most Malaysian dentists. About half of the respondents used FS/PRR occasionally (48.4%), while few (13.7%) applied them routinely. The majority of the dentists agreed that minimally invasive dentistry is important and FS are effective in caries prevention, using them on high caries-risk individuals. Most of the dentists used pumice or paste to clean teeth before placing FS/PRR. A significant number of dentists used a bonding agent prior to placing FS. Although only 57.5% dentists were aware of guidelines for FS use, most dentists agreed that guidelines are important.

Conclusion: Although there was a positive attitude towards FS/PRR, few dentists applied them routinely. Some of the steps undertaken for placement of FS and PRR were outdated. Updating local guidelines for dentists to ensure uniform practice of FS and PRR is justified.

Key words: attitude, fissure sealants, knowledge, Malaysian dentists, preventive resin restorations, utilisation

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Pits and fissures on tooth surfaces are the most common sites of caries.⁸ Fissure sealants (FS) are materials which block the pits and fissures of teeth in order to prevent or control the development of caries.²³ Evidence has shown that FS application results in over 50% caries reduction after 4.5 years on permanent molars.² Regular monitoring based on caries risk is essential for a good long-term prognosis.^{26,31}

The concept of preventive resin restoration (PRR) was first introduced in the 1970s and represented a major development in the treatment of minimal pit and fissure caries.³⁰ It is a conservative form of

treatment involving removal of carious dental tissue, replacement of the lost tooth structure with adhesive restorative material and sealing of the remaining unaffected fissures.¹¹ Hence, it combines both preventive and restorative aspects.¹¹

Based on the Malaysian National Oral Health Survey of School Children 2007, there has been a small decline of caries prevalence among 6-year-olds from 80.9% in 1997 to 74.5% in 2007.²⁵ This prevalence is still very high when compared to the National Oral Health Plan's goal of 50% caries-free set by the Malaysian Ministry of Health for 2011–2020.²⁵ Several public preventive measures are in place in Malaysia, such as water fluoridation since 1972²⁴ and a school-based fissure sealant programme since 1999.²³ Oral health is constantly promoted and monitored through programmes for various age groups: a toddler programme, pre-school service, school dental service, antenatal service and service for children with special needs.²² In conjunction with existing programmes, the appropriate use of preventive measures such as FS and PRR by dentists can further reduce the prevalence of pit-and-fissure caries in Malaysia.

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Studies have been undertaken worldwide to assess the use of sealants by dentists in different countries.^{12,15,19,26,27} In Malaysia, a study concerning usage of FS among Malaysian dentists was done more than 20 years ago and assessed the general knowledge, attitude and utilisation of FS.¹ Regarding PRR, there is only one study from England¹¹ which assessed its usage and attitude among dentists, while there are none in Malaysia to the best of the authors' knowledge.

Accompanying the establishment of the National Oral Health Plan for Malaysia 2011–2020, it is important to know the extent and pattern of use of FS and PRR by Malaysian dentists. It is also worthwhile to assess whether uniform criteria for fissure sealing and PRR are being used by the dental professionals in Malaysia. Hence, the aim of this study was to assess the current trend in knowledge of, attitude towards and utilisation of both fissure sealants and preventive resin restorations among Malaysian dentists.

MATERIALS AND METHODS

A questionnaire consisting of 35 questions addressing the practice of both FS and PRR was designed. There were 7 questions on dentists' demographic data, 7 questions on utilisation, 9 attitude-related questions and 12 knowledge-related questions. A pre-test was done on 5 dentists to clarify ambiguities in the questionnaire.

The research protocol was approved by the Medical Ethics Committee, Faculty of Dentistry, University of Malaya to conduct the survey among dentists working in the private sector and academic institutions. In addition, ethical clearance was also obtained from the Medical Research Ethics Committee (MREC) of the Ministry of Health to conduct the survey among the dentists working under the Ministry of Health. Informed consent was obtained from all the selected dentists prior to the survey. All responses were kept confidential and used only for survey purposes.

The participants were selected from dentists registered under the Malaysian Dental Council and holding a valid Annual Practising Certificate (APC). A complete list of potential participants was obtained from the Dental Practitioners Information Management System (dpims.moh.gov.my, last updated 25/7/2012). The participants were then regrouped according to their main place of work: private practice (1884), academic institution/

university (349) and Ministry of Health (2048). Stratified random sampling was done to obtain a final sample size of 425 (private practice = 200, universities = 75, Ministry of Health = 150).

The self-administered questionnaire together with Malay and English versions of a participant information sheet and consent form were distributed to the selected dentists by postal service or personally by visiting their clinics. A stamped envelope with a return address was provided to allow return of the questionnaire by mail. Simultaneously, the selected dentists were given an option to respond to the survey online by providing them a link and password to access the survey. The online questionnaire was created using a free service provider (Qualtrics Survey) for the convenience of the participants. Three weeks after the initial mailing, non-respondents were reminded by phone, e-mail or follow-up visits to their clinics. Online and postal questionnaires were re-sent to those who did not receive them in the first attempt and were willing to respond to the survey.

SPSS 12.0.1 was used to analyse the data and descriptive statistics were used to tabulate the results.

RESULTS

Of the 425 Malaysian dentists, 153 (36.0%) responded to the questionnaire. They comprised 51 (33.3%) private dentists, 70 (45.8%) dentists from the Ministry of Health (MOH) and 32 (20.9%) dentists affiliated with academic institutions. Table 1 shows the demographic data of dentists with regard to main place of work, gender, age, years in practice and specialisation.

Table 2 shows the utilisation of FS and PRR by dentists according to main place of work. Of the 153 dentists who responded, almost half (48.4%) of them used FS occasionally and only 13.7% used them routinely. Similarly, slightly more than half of the dentists (51.6%) practiced PRR occasionally.

The most commonly used sealant class was resin-based with fluoride (58.2%) (Table 2). Figure 1 shows that of the types (clear, opaque, coloured) of resin-based sealant used, opaque was the most common (74.0%). Regarding the type of PRR used, composite and sealant were popular among dentists from the MOH (76.8%) and universities (63.3%), while flowable composite was widely used among private dentists (47.9%). Figure 2 shows the percentage of dentists who monitored FS/PRR and

Table 1 Demographic data of the 153 respondents

Response	Main place of work				Overall (153) n (%)
	Private dental practice (51) n (%)	Ministry of Health (70) n (%)	University/academic institution (32) n (%)		
Gender	Male	31 (60.8%)	26 (37.1%)	9 (28.1%)	66 (43.1%)
	Female	20 (39.2%)	44 (62.9%)	23 (71.9%)	87 (56.9%)
Age in years	21–40	23 (45.1%)	70 (100.0%)	20 (62.5%)	113 (73.8%)
	41–60	19 (37.3%)	0 (0.0%)	12 (37.5%)	31 (20.3%)
	≥61	9 (17.6%)	0 (0.0%)	0 (0.0%)	9 (5.9%)
Years in practice	0–9	19 (37.3%)	70 (100.0%)	9 (28.1%)	98 (64.0%)
	10–19	12 (23.5%)	0 (0.0%)	18 (56.3%)	30 (19.7%)
	20–29	8 (15.7%)	0 (0.0%)	5 (15.6%)	13 (8.5%)
	30–39	9 (17.6%)	0 (0.0%)	0 (0.0%)	9 (5.9%)
	≥40	3 (5.9%)	0 (0.0%)	0 (0.0%)	3 (2.0%)
Specialisation	Yes	0 (0.0%)	1 (1.4%)	28 (87.5%)	29 (19.0%)
	No (BDS)	51 (100.0%)	69 (98.6%)	4 (12.5%)	124 (81.0%)

Table 2 Utilisation of FS and PRR

Response	Main place of work			Overall n (%)	
	Private dental practice n (%)	Ministry of Health n (%)	University/academic institution n (%)		
Usage of FS	Routinely	5 (9.8%)	12 (17.1%)	4 (12.5%)	21 (13.7%)
	Occasionally	28 (54.9%)	31 (44.3%)	15 (46.9%)	74 (48.4%)
	Rarely	17 (33.3%)	26 (37.1%)	11 (34.4%)	54 (35.3%)
	Never	1 (2.0%)	1 (1.4%)	2 (6.3%)	4 (2.6%)
Usage of PRR	Routinely	9 (17.6%)	5 (7.1%)	4 (12.5%)	18 (11.8%)
	Occasionally	25 (49.0%)	36 (51.4%)	18 (56.3%)	79 (51.6%)
	Rarely	14 (27.5%)	28 (40.0%)	8 (25.0%)	50 (32.7%)
	Never	3 (5.9%)	1 (1.4%)	2 (6.3%)	6 (3.9%)
*Types of FS	Resin-based with fluoride	26 (51.0%)	44 (62.9%)	19 (59.4%)	89 (58.2%)
	Resin-based without fluoride	3 (5.9%)	17 (24.3%)	5 (15.6%)	25 (16.3%)
	GIC	21 (41.2%)	28 (40.0%)	7 (21.9%)	56 (36.6%)
	Resin-modified GIC	11 (21.6%)	12 (17.1%)	9 (28.1%)	32 (20.9%)
	Flowable composite	28 (54.9%)	33 (47.1%)	14 (43.8%)	75 (49.0%)
	Compomers	1 (2.0%)	0 (0.0%)	0 (0.0%)	1 (0.70%)
*Types of PRR (6 missing data)	GIC and sealant	21 (43.8%)	13 (18.8%)	7 (23.3%)	41 (27.9%)
	Composite and sealant	17 (35.4%)	53 (76.8%)	19 (63.3%)	89 (60.5%)
	Composite and GIC and sealant	13 (27.1%)	9 (13.0%)	7 (23.3%)	29 (19.7%)
	Flowable composite only	23 (47.9%)	22 (31.9%)	8 (26.7%)	53 (36.1%)
	Sealant only	21 (43.8%)	13 (18.8%)	7 (23.3%)	41 (27.9%)

*As some dentists expressed more than one answer, the percentage total may be greater than 100%.

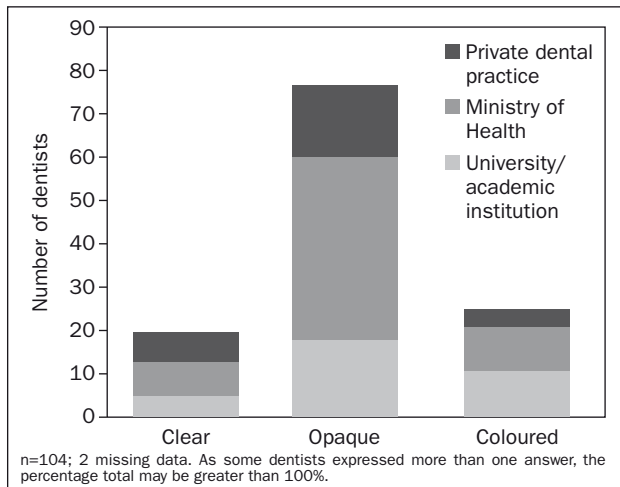
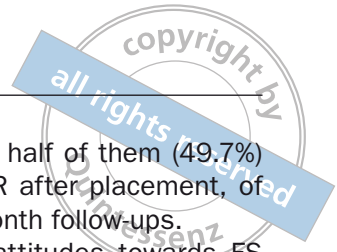


Fig 1 Types of resin-base sealant used by dentists.

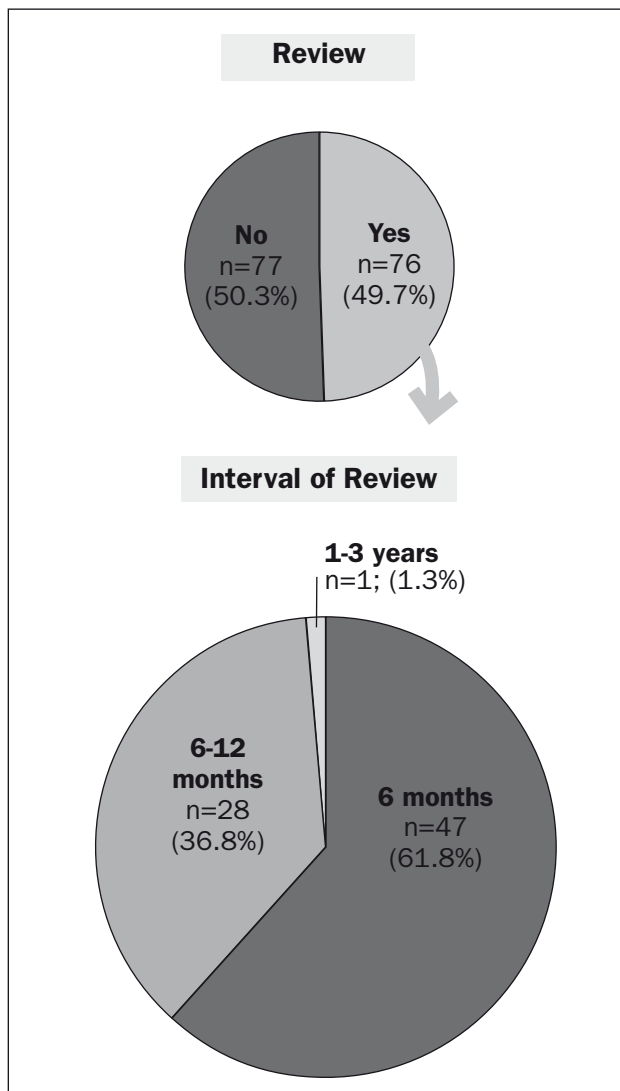


Fig 2 Percentage of dentists who monitored FS/PRR and the interval of recall.

the interval of recall. Almost half of them (49.7%) reportedly monitored FS/PRR after placement, of which 61.8% performed 6-month follow-ups.

Table 3 shows dentists' attitudes towards FS and PRR usage. Most agreed or strongly agreed that minimal intervention was important and FS was effective in caries prevention.

The reasons for the lack of utilisation among the 69 respondents who rarely or never applied FS/PRR are shown in Fig 3. Information regarding FS/PRR was obtained predominantly from undergraduate instruction (68.0%), dental journals (46.4%) and continuing education programmes (42.5%). While most dentists (82.3%) agreed that guidelines/policies were important or very important, only 57.5% were aware of existing guidelines for FS/PRR (Fig 4).

Indications and procedures for FS/PRR placement were included under the knowledge domain and are shown in Table 4. Overall, a majority of the dentists placed FS in high caries-risk (73.9%) and cooperative patients (90.2%). More than half of the respondents (60.8%) only sealed fully erupted teeth. All dentists (100%) sealed permanent molars, whereas only 46.4% sealed permanent premolars and 14.4% sealed deciduous teeth.

DISCUSSION

This study is the first in Malaysia which assessed the comprehensive use of FS and PRR among dentists. The low response rate (36%) in our study was unexpected, based on a previous study in Malaysia with a 61.1% response rate.¹ Low response rates are one of the drawbacks of surveys of this nature. Similar studies conducted elsewhere, however, had response rates over 80%.^{11,19,26}

Of the respondents, 97.4% claimed to use FS, but only 13.7% used them routinely. A previous study in Malaysia revealed that only 52.6% used sealants.¹ This encouraging trend reflects an increase in preventive and minimal-intervention philosophy among Malaysian dentists. Similar results were reported elsewhere, where a majority (87.6%) utilised FS, but only 35.8% used them on a regular basis.¹⁹ Seventy-five percent of dentists in England claimed to practice PRR, while only 47% actually placed them.¹¹ About 60% of the dentists in the present study preferred resin-based FS with fluoride, which is probably due to their anti-cariogenic effect. In Greece,¹⁹ only 22.1% of dentists preferred fluoride-containing FS material, possibly because

Table 3 Attitude of dentists regarding FS and PRR

Factor	Response	Main place of work			Overall n (%)
		Private dental practice n (%)	Ministry of Health n (%)	University/academic Institution n (%)	
Importance of minimal intervention	Strongly agree	23 (45.1%)	44 (62.9%)	20 (62.5%)	87 (56.9%)
	Agree	26 (51.0%)	25 (35.7%)	11 (34.4%)	62 (40.5%)
	Undecided	2 (3.9%)	1 (1.4%)	1 (3.1%)	4 (2.6%)
	Disagree	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Strongly disagree	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Effectiveness of FS in caries prevention	Strongly agree	14 (27.5%)	22 (31.4%)	13 (40.6%)	49 (32.0%)
	Agree	35 (68.6%)	44 (62.9%)	19 (59.4%)	98 (64.1%)
	Undecided	2 (3.9%)	4 (5.7%)	0 (0.0%)	6 (3.9%)
	Disagree	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Strongly disagree	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
*Benefits of using PRR	Conserves tooth tissue	37 (72.5%)	46 (65.7%)	25 (78.1%)	108 (70.6%)
	Aesthetic restoration	22 (43.1%)	19 (27.1%)	14 (43.8%)	55 (35.9%)
	Mercury free	19 (37.3%)	20 (28.6%)	11 (34.4%)	50 (32.7%)
	Fluoride release from GIC	33 (64.7%)	30 (42.9%)	12 (37.5%)	75 (49.0%)
	Combined restorative and preventive procedure	37 (72.5%)	61 (87.1%)	22 (68.8%)	120 (78.4%)
	Better marginal seal than amalgam	10 (19.6%)	11 (15.7%)	7 (21.9%)	28 (18.3%)
	Early caries prevention	42 (82.4%)	57 (81.4%)	25 (78.1%)	124 (81.0%)
*Concerns regarding FS/PRR	Poor retention	17 (33.3%)	28 (40.0%)	11 (34.4%)	56 (36.6%)
	Incomplete caries removal	20 (39.2%)	16 (22.9%)	9 (28.1%)	45 (29.4%)
	Moisture control difficulties	25 (49.0%)	54 (77.1%)	21 (65.6%)	100 (65.4%)
	Low cost-effectiveness	6 (11.8%)	1 (1.4%)	2 (6.3%)	9 (5.9%)
	Recurrent caries due to marginal leakage/partial retention	32 (62.7%)	42 (60.0%)	17 (53.1%)	91 (59.5%)
	Marginal shrinkage	15 (29.4%)	22 (31.4%)	6 (18.8%)	43 (28.1%)
	No idea about any concerns	1 (2.0%)	0 (0.0%)	0 (0.0%)	1 (0.7%)
	No concern	5 (9.8%)	2 (2.9%)	1 (3.1%)	8 (5.2%)
*Sources of information regarding the use of FS/PRR	Ineffective	1 (2.0%)	0 (0.0%)	0 (0.0%)	1 (0.7%)
	Dental journals	28 (54.9%)	23 (32.9%)	20 (62.5%)	71 (46.4%)
	Postgraduate courses	3 (5.9%)	0 (0.0%)	3 (9.4%)	6 (3.9%)
	Undergraduate courses	26 (51.0%)	64 (91.4%)	14 (43.8%)	104 (68.0%)
	Trade fairs/conferences	23 (45.1%)	8 (11.4%)	7 (21.9%)	38 (24.8%)
	Videos	1 (2.0%)	2 (2.9%)	0 (0.0%)	3 (2.0%)
	Continuing education programmes	26 (51.0%)	20 (28.6%)	19 (59.4%)	65 (42.5%)
	Website/Internet	2 (3.9%)	0 (0.0%)	0 (0.0%)	2 (1.3%)
	Dental material suppliers	1 (2.0%)	0 (0.0%)	0 (0.0%)	1 (0.7%)
Importance of policy/guidelines	Colleagues	0 (0.0%)	0 (0.0%)	2 (6.3%)	2 (1.3%)
	Very important	14 (27.5%)	27 (38.6%)	14 (43.8%)	55 (35.9%)
	Important	27 (52.9%)	31 (44.3%)	13 (40.6%)	71 (46.4%)
	Moderately important	8 (15.7%)	10 (14.3%)	4 (12.5%)	22 (14.4%)
	Of little importance	2 (3.9%)	2 (2.9%)	1 (3.1%)	5 (3.3%)
Unimportant	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	

*As some dentists expressed more than one answer, the percentage total may be greater than 100%.

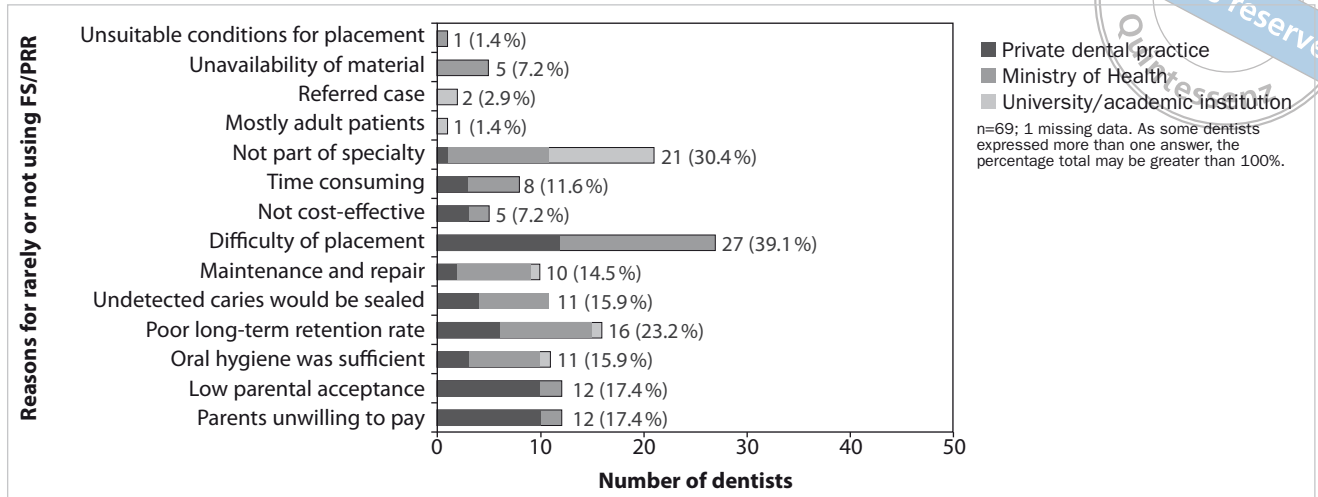
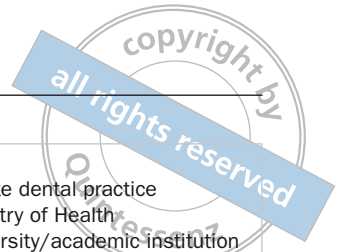


Fig 3 Reasons for rarely or not using FS/PRR among dentists.

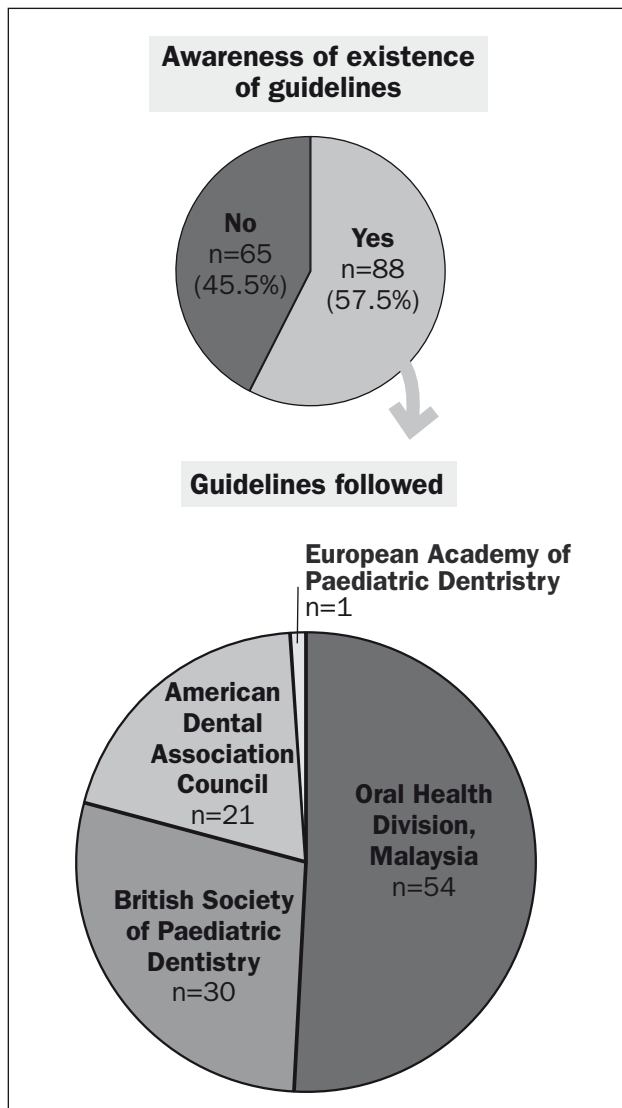
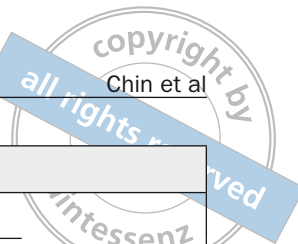


Fig 4 Awareness of existence of guidelines among dentists and guidelines followed.

the effectiveness of fluoride release is not proven.²⁰ Another well-known fluoride releasing material, glass-ionomer cement (GIC), was the third most preferred FS, after flowable composites. This may be due to concern regarding the low retention rates of GIC and conflicting evidence regarding its efficacy.^{3,14} Flowable composites were more popular among private practitioners in this study and others,²⁶ perhaps because of the multiple uses of this material in a private practice setting. Composite plus sealant was a more popular combination for PRR in this study and in England.¹¹

Only half of the total respondents monitored FS and PRR after placement. This finding was unexpected, since many guidelines emphasise periodic follow-up for sealant effectiveness.^{3,31,32} While fewer dentists evaluated FS in older surveys elsewhere,¹⁵ 80%–100% of dentists¹⁹ and specialists²⁶ evaluated sealants in more recent surveys. Malaysian dentists who re-evaluated sealants did so at 6 months or within 12 months, similar to other studies²⁶ and based on the current recommendation.¹³

Around 90% of dentists agreed or strongly agreed that minimally invasive dentistry and FS in caries prevention are important, but this was not reflected in the usage of FS in this study. Other studies also show similar positive attitudes among dentists.^{19,28} Most dentists in this survey perceived that the greatest benefit of PRR was early caries prevention, followed by its advantage of combining both prevention and restoration. Dentists elsewhere perceived other benefits, such as dental tissue conservation (41%), aesthetics (34%) and mercury-free restoration (20%).¹¹ On the other hand, dentists' main concerns regarding FS and PRR in

**Table 4 Knowledge of dentists regarding factors to be considered before FS placement**

Factor	Response	Main place of work			Overall n (%)
		Private dental practice n (%)	Ministry of Health n (%)	University/academic Institution n (%)	
Caries risk	Low caries risk	10 (19.6%)	12 (17.1%)	6 (18.8%)	28 (18.3%)
	High caries risk	35 (68.6%)	54 (77.1%)	24 (75.0%)	113 (73.9%)
	Not considered	6 (11.8%)	4 (5.7%)	2 (6.3%)	12 (7.8%)
Tooth eruption status	Completely erupted	27 (52.9%)	47 (67.1%)	19 (59.4%)	93 (60.8%)
	Partially erupted	10 (19.6%)	10 (14.3%)	7 (21.9%)	27 (17.6%)
	Not considered	14 (27.5%)	13 (18.6%)	6 (18.8%)	33 (21.6%)
Patient behaviour	Cooperative	47 (92.9%)	63 (90.0%)	28 (87.5%)	138 (90.2%)
	Non cooperative	1 (2.0%)	1 (1.4%)	0 (0.0%)	2 (1.3%)
	Not important	3 (5.9%)	6 (8.6%)	4 (12.5%)	13 (8.5%)
*Type of tooth to be sealed	Permanent premolar	25 (49.0%)	28 (40.0%)	18 (56.3%)	71 (46.4%)
	Permanent molar	51 (100.0%)	70 (100%)	32 (100.0%)	153 (100.0%)
	Primary teeth	12 (23.5%)	7 (10.0%)	3 (9.4%)	22 (14.4%)
*Type of surface to be sealed	Occlusal	51 (100.0%)	70 (100%)	32 (100.0%)	153 (100.0%)
	Buccal pit	37 (72.5%)	47 (67.1%)	23 (71.9%)	107 (69.9%)
	Cingulum	20 (39.2%)	32 (45.7%)	18 (56.3%)	70 (45.8%)

*As some dentists expressed more than one answer, the percentage total may be greater than 100%.

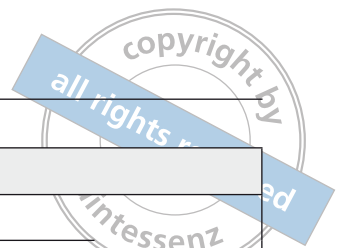
this study were difficulties in moisture control during sealant placement as well as recurrent caries due to marginal leakage or partial retention, which was similar to findings among dentists in England.¹¹ These perceived problems may be the reason many dentists used PRR only occasionally or rarely (84.3%) in this study.

Among the 45.1% respondents who rarely or never use FS/PRR in their daily practice, the primary reasons were 'difficulties in placement due to lack of patient cooperation' and 'unrelated to dentists' specialty'. This is possibly because FS/PRR is characteristically indicated in children, where cooperation is a challenge. Evidently, only 20.9% used them on adults in this study. However, FS/PRR is currently recommended for all age groups with high caries risk.^{13,15,19} Finnish dentists who did not use FS/PRR considered it less cost effective.¹⁵ Private dentists in this study stated 'low parental acceptance and unwillingness to pay for preventive measures' as the main reason for low usage. Unavailability of material at the workplace was the problem facing dentists from the MOH (14.3%), implying that

material availability would encourage its use in government clinics.

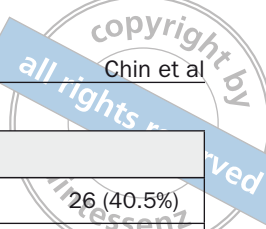
Information regarding FS and PRR was obtained mainly from undergraduate courses by 70% of Malaysian dentists, with other sources being dental journals and continuing education programmes. However, a majority of dentists in England obtained information through dental journals (70%) and only 20% from undergraduate courses.¹¹ This causes concern that knowledge from undergraduate courses may be limited and at some point outdated. A study in Finland reported that a total of 59% (1991) and 48% (2001) of the respondents used specific guidelines for sealing molar fissures.¹⁵ In our study, 57.5% of the dentists were aware of guidelines regarding FS and PRR, and roughly 80% of dentists thought that guidelines were important or very important. In Malaysia, guidelines for school-based FS programme exist,²³ but there is no specific guideline for chairside use of FS/PRR.

FS are indicated in patients with high caries risk to increase cost effectiveness.¹⁰ A majority of dentists in the USA placed FS regardless of the child's

**Table 5 Knowledge of dentists regarding factors involved in FS and PRR placement**

Factor	Response	Main place of work			Overall n (%)
		Private dental practice n (%)	Ministry of Health n (%)	University/academic institution n (%)	
*Method of evaluation prior to FS/PRR placement	Visual	49 (96.1%)	69 (98.6%)	32 (100.0%)	150 (98.0%)
	Tactile	39 (76.5%)	57 (81.4%)	26 (81.3%)	122 (79.7%)
	Radiographic	4 (7.8%)	9 (12.9%)	4 (12.5%)	17 (11.1%)
	Fibre-optic transillumination	4 (7.8%)	8 (11.4%)	3 (9.4%)	15 (9.8%)
	Air abrasion	3 (5.9%)	11 (15.7%)	3 (9.4%)	17 (11.1%)
	Electronic	3 (5.9%)	9 (12.9%)	7 (21.9%)	19 (12.4%)
*Types of fissure sealed	Deep, caries-free fissure	42 (82.4%)	63 (90.0%)	28 (87.5%)	133 (86.9%)
	Shallow, caries-free fissure	10 (19.6%)	6 (8.6%)	6 (18.8%)	22 (14.4%)
	Questionable (coloured/decalcified) fissure	27 (52.9%)	38 (54.3%)	11 (34.4%)	76 (49.7%)
	Incipient caries	22 (43.1%)	18 (25.7%)	7 (21.9%)	47 (30.7%)
	Overt caries	2 (3.9%)	1 (1.4%)	0 (0.0%)	3 (2.0%)
	Stained fissure	9 (17.6%)	25 (35.7%)	8 (25.0%)	42 (27.5%)
	Hypomineralised/ hypoplastic fissure	23 (45.1%)	26 (37.1%)	13 (40.6%)	62 (40.5%)
*Patient's age	Children (≤ 12)	49 (96.0%)	68 (97.1%)	29 (90.6%)	146 (95.4%)
	Adolescent (13–17)	34 (66.7%)	40 (57.1%)	25 (78.1%)	99 (64.7%)
	Adult (≥ 18)	10 (19.6%)	11 (15.7%)	11 (34.4%)	32 (20.9%)
*Method of isolation	Cotton roll	50 (98.0%)	68 (97.1%)	23 (71.9%)	141 (92.2%)
	Rubber-dam	6 (11.8%)	28 (40.0%)	21 (65.6%)	55 (35.9%)
	Saliva ejector	46 (90.2%)	63 (90.0%)	21 (65.6%)	130 (85.0%)
	Blow dry with 3-way syringe	1 (2.0%)	1 (1.4%)	0 (0.0%)	2 (1.3%)
	Cheek/tongue retractor	1 (2.0%)	0 (0.0%)	0 (0.0%)	1 (0.7%)
*Surface cleansing method	Explorer	20 (39.2%)	12 (17.1%)	6 (18.8%)	38 (24.8%)
	Pumice/paste	39 (76.5%)	66 (94.3%)	27 (84.4%)	132 (86.3%)
	Rotary cup/brush	36 (70.6%)	57 (81.4%)	24 (75.0%)	117 (76.5%)
	Toothbrush	1 (2.0%)	1 (1.4%)	0 (0.0%)	2 (1.3%)
	Hydrogen peroxide	1 (2.0%)	0 (0.0%)	0 (0.0%)	1 (0.7%)
	Air abrasive polisher	9 (17.6%)	6 (8.6%)	3 (9.4%)	18 (11.8%)
	Phosphoric acid	1 (2.0%)	0 (0.0%)	0 (0.0%)	1 (0.7%)
	3-way syringe	1 (2.0%)	0 (0.0%)	0 (0.0%)	1 (0.7%)
	Fine and round diamond bur	0 (0.0%)	0 (0.0%)	1 (3.1%)	1 (0.7%)
	Not used	1 (2.0%)	2 (2.9%)	1 (3.1%)	4 (2.6%)

continued on next page

**Table 5 (continued) Knowledge of dentists regarding factors involved in FS and PRR placement**

*Method of tooth preparation	Slow-speed bur	27 (52.9%)	24 (34.3%)	11 (34.4%)	26 (40.5%)
	High-speed bur	16 (31.4%)	16 (22.9%)	11 (34.4%)	43 (28.1%)
	Air abrasion	12 (23.5%)	8 (11.4%)	3 (9.4%)	23 (15.0%)
	Scaler tip	1 (2.0%)	0 (0.0%)	1 (3.1%)	2 (1.3%)
	Not performed	16 (31.4%)	44 (62.9%)	16 (50.0%)	76 (49.7%)
Duration of etching	15–20 s	40 (78.4%)	62 (88.6%)	25 (78.1%)	127 (83.0%)
	30–45 s	9 (17.6%)	8 (11.4%)	4 (12.5%)	21 (13.7%)
	60–120 s	2 (3.9%)	0 (0.0%)	2 (6.3%)	4 (2.6%)
	As per manufacturer's instructions	0 (0.0%)	0 (0.0%)	1 (3.1%)	1 (0.7%)
Duration of rinsing	0-10 s	16 (31.4%)	21 (30.0%)	8 (25.0%)	45 (29.4%)
	15-20 s	12 (23.5%)	29 (41.4%)	16 (50.0%)	57 (37.3%)
	30-45 s	9 (17.6%)	5 (7.0%)	0 (0.0%)	14 (9.2%)
	Do not time, stop when etchant is washed off	14 (27.5%)	15 (21.4%)	8 (25.0%)	37 (24.2%)
Duration of drying	0-10 s	18 (35.3%)	31 (44.3%)	15 (46.9%)	64 (41.8%)
	15-20 s	7 (13.7%)	15 (21.4%)	6 (18.8%)	28 (18.3%)
	30-45 s	3 (5.9%)	0 (0.0%)	0 (0.0%)	3 (2.0%)
	Do not time, stop when frosty white appearance is noticed	23 (45.1%)	24 (34.3%)	10 (31.3%)	57 (37.3%)
	As per manufacturer's instructions	0 (0.0%)	0 (0.0%)	1 (0.7%)	1 (0.7%)
Bonding agent (2 missing data points)	Used	43 (84.3%)	42 (60.9%)	25 (80.6%)	110 (72.8%)
	Not used	8 (15.7%)	27 (39.1%)	6 (19.4%)	41 (27.2%)
*Method of evaluation after FS/PRR placement	Visual	26 (51.0%)	44 (62.9%)	19 (59.4%)	89 (58.2%)
	Blunt instrument	3 (5.9%)	17 (24.3%)	5 (15.6%)	25 (16.3%)
	Explorer used gently	21 (41.2%)	28 (40.0%)	7 (21.9%)	56 (36.6%)
	Explorer used forcefully	11 (21.6%)	12 (17.1%)	9 (28.1%)	32 (20.9%)
	Occlusion checked	28 (54.9%)	33 (47.1%)	14 (43.8%)	75 (49.0%)
	Do not evaluate	1 (2.0%)	0 (0.0%)	0 (0.0%)	1 (0.7%)

*As some dentists expressed more than one answer, the percentage total is greater than 100%.

caries risk and selectively in cooperative patients only.²⁶ Most respondents in our study considered the caries risk before placing FS. Since caries risk and plaque accumulation are greatest during eruption,⁶ FS should be applied regardless of eruption status. In the USA, about 25% of the respondents did not consider the eruption status before placing FS.²⁶ Similarly, in our survey, less than 30% of the dentists did not consider eruption status and more than half of the dentists chose to seal only com-

pletely erupted teeth. Most dentists in this study sealed permanent molar and premolars, while a small percentage of dentists sealed primary teeth, as also documented in other studies.^{19,26}

Almost all respondents visually inspected a tooth before placing FS and a high percentage of dentists also used tactile examination, as do dentists elsewhere.²⁶ Radiographic assessment was done by only 11.1% of the dentists, possibly due to concern about unnecessary radiation exposure. However, in

the USA, more than half of the dentists used radiographic aids for treatment planning with FS.²⁶ Radiographs are recommended prior to placing FS, but only when the extent of caries is questionable.⁴ Most dentists (98.0%) supported sealing deep, caries-free fissures. Although sealing incipient caries is now acceptable,^{9,18} many dentists in this study were reluctant to seal incipient caries, questionable, stained and hypomineralised fissures. Similar findings were also reported for Greece and the USA,^{19,26} whereas in Finland, the proportion of respondents who sealed enamel caries increased from 30% in 1991 to 37% in 2001.¹⁵ Proper moisture isolation is vital for the success of FS.¹⁰ Both in the current and other recent studies, cotton-roll isolation was the most frequent method of moisture control.^{19,21,26} Rubber-dam isolation was preferred by 35.9% dentists in this study.

The optimal cleansing method prior to FS/PRR placement is controversial. Earlier protocols used pumice and air-polishing instruments, while more recently, cleaning of tooth surfaces with a dry toothbrush or dry bristle brush in a slow handpiece without an abrasive is considered effective.¹⁶ In our study, 86.3% used pumice or paste and only 1.3% used a toothbrush prior to FS/PRR placement. The pumice/paste and explorer method was also used more frequently than a toothbrush in the USA.²⁶ Mechanical preparation of enamel prior to FS placement is not recommended,⁴ since it provides no additional benefit.^{5,17,29} However, in the present study, nearly half of the respondents prepared the tooth indicated for FS either by slow-speed bur, high-speed bur or air abrasion, similar to the USA.²⁶ A 15- to 20-s etch is adequate for sealant retention,³² since varying etching times did not alter retention rates.^{7,32} Regardless of the time spent, the end result of rinsing and drying should reveal a frosty white appearance.¹³ In our survey, 15–20 s of etching was most frequently mentioned, which was similar to that reported among American dentists.²⁶ The preferred rinsing time in our study was 15–20 s and that of drying 0–10 s, again similar to that practiced by American dentists.²⁶ However, it was notable that many dentists did not time the rinsing and drying duration, but rather stopped washing when etchant was rinsed away (24.2%) or stopped drying when the frosty appearance was noted (37.3%). This may be a more convenient or practical approach, which needs further research.

Bonding agent application prior to FS placement is recommended in situations where moisture isolation is difficult, since it improves bond strength.^{3,31}

Routine use of a bonding agent is not recommended, given the inconclusive clinical evidence available.¹³ In our study, 72% applied bonding agent, mainly private practitioners and academicians. Similarly, private practitioners elsewhere were also inclined to use bonding agent more frequently.²⁶ Evaluating sealants immediately after placement is critical for their success. In this study, 57.5% used an explorer and 49.0% checked the occlusion as recommended.²³ While it is recommended that attempts should be made to dislodge the sealant using an explorer to test retention,³² only 20.9% of the respondents used the explorer forcefully. However, about 50% of the respondents used the explorer forcefully and checked the occlusion in the USA.²⁶

The chief shortcoming of this study is that responses may not reflect the true practice of FS and PRR among Malaysian dentists; a potential for misinterpretation by the respondents also exists. Further, the results from this study may not be representative of all Malaysian dentists because of the small sample size. However, this study provides the preliminary findings of the current practice of FS and PRR in Malaysia. The results from our study may serve as a platform for further, detailed and large-scale research concerning FS and PRR use among Malaysian dentists.

CONCLUSION

The majority of the dentists in this study showed a positive attitude towards FS and PRR, but most dentists did not apply FS and PRR routinely. Additionally, many Malaysian dentists are unfamiliar with specific clinical guidelines. Since new concepts related to FS and PRR emerge constantly, updated guidelines would be recommendable to increase dentists' current knowledge about FS and PRR.

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