# EDUCATIONAL EXPERIENCES, ATTITUDE AND PRACTICE OF RESIN INFILTRATION AMONGST MALAYSIAN PEDIATRIC DENTAL SPECIALIST & POST-GRADUATE STUDENTS: A PRELIMINARY STUDY

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***Abstract***
**Objectives:** (i) To evaluate the educational experiences, attitude and practice of resin infiltration (RI) amongst Malaysian Paediatric Dental Specialists and post-graduate students (ii) to determine the relationship between their educational experiences and attitude in the practice of RI in children. **Material & Methods:** This cross-sectional study used a self-administered questionnaire distributed online to Malaysian Association of Paediatric Dentistry (MAPD) members from December 2022 to February 2023. Demographics, educational experiences, attitudes, and RI use were measured. Descriptive data, Cronbach alpha coefficient, and Pearson correlation tests were obtained. **Results:** Out of the 110 invited members, 30 surveys were completed, with a response rate of 27.3%. The knowledge subscale comprised 19 items (α=0.84), and the attitude/practice subscale had 11 items (α=0.77). A total of 46.7% agreed that their undergraduate training had prepared them well to use RI with paediatric patients. 93.4% of respondents felt their training in paediatric graduate programs had informed and adequately prepared them for RI usage. Most respondents expressed interest in learning more about RI (100%) and attending continuing education course (93.3%). The respondents positively viewed RI, especially its aesthetic benefit (100%). Only 16.7% of respondents used RI frequently, while others used it rarely (63%) or never (20%). There was no correlation between education experiences and attitude in using RI (r=0.14: p<0.46). **Conclusion:** While the correlation was not significant, this study showed the need to incorporate RI into the dental curriculum. Hence, expanding undergraduate, postgraduate, and continuing professional education in RI should be strengthened.

**Keywords:** Children, Dental Education, Minimally Invasive Dentistry, Paediatric Dentistry, Resin Infiltration

## *Introduction*

Early childhood caries represents a global health issue that affects about half of all preschool children (1). Even though dental caries is a preventable chronic health disease, recent global reports suggest that oral health has not improved in the last 25 years, with 573 million children having untreated dental caries in primary teeth in 2015 (2). A countrywide assessment of five-year-old preschool children in Malaysia found that the prevalence of caries is 71.3%. Despite a lowering caries trend, the caries-free prevalence was far from the National Oral Health aims to achieve a 50% caries-free score among six-year-old children by 2020 (3). The focus in dentistry today in caries management emphasizes early prevention and detection of caries, which has created the concept of minimally invasive dentistry (MID). In MID, conserving healthy tooth structure is the primary goal. MID treatment approach includes stepwise caries excavation, selective caries removal, fluoride varnish application, application of silver diamine fluoride, pits and fissure sealants, atraumatic restorative treatment, the use of resin infiltrations

(RI), and the placement of stainless-steel crowns using the Halls technique. Minimally invasive caries management techniques are gaining popularity in paediatric dentistry as they are less invasive than conventional treatment, are inexpensive, save time, are more appealing to children and are easier to accept in pre-cooperative and uncooperative children. It has been found that refraining from using a high-speed drill lowers young patients' dental fear, enhances their contact with the dentist, and fosters their trust and cooperation during treatment (4).

Resin infiltration (RI) is a cutting-edge method of treating early carious lesions aligning seamlessly with the MID concept. It serves as a modern technique for managing interproximal non-cavitated lesions on smooth surfaces of primary and permanent teeth. RI was introduced in the 1970s as an alternative dental treatment to a more invasive approach (5). A low-viscosity resin is made to penetrate the porous lesion body of enamel caries. Upon polymerised, the resin acts as a defence against acids thereby, in theory, stopping lesions from spreading (6). Additionally, RI has its merits aesthetically as it can reduce enamel discolouration in a tooth with an enamel defect. The effectiveness of RI has been proven in many studies. RI has been shown in randomised clinical studies to be more efficient than preventative treatments alone in slowing the radiographic progression of early or incipient proximal lesions on primary molars over 24 months. However, only a few RCTs examine resin infiltration's long-term efficacy (6, 7). A systematic review by Doméjean et al., focusing on the effectiveness of RI in non-cavitated lesions, concluded that RI appeared to be effective in arresting the progression of those lesions (8).

Owing to numerous positive research results regarding the utilization of RI, the American Academy of Paediatric Dentistry (AAPD) currently considers RI as an adjunct to preventive measures for primary and permanent teeth with small, noncavitated interproximal lesions and for white spot lesions to improve their clinical appearance. Given the benefits of the minimally invasive nature of RI use in children, this discovery should prompt dental academicians to consider teaching RI in the undergraduate and postgraduate dental curriculum. Currently, no research has been done on the use of RI amongst Paediatric Dentists in Malaysia. Therefore, the purpose of this study is to evaluate the educational experiences, attitudes and practice of RI in children among Paediatric Dentists in Malaysia.

## *Materials and Method*

### *Study design*

This prospective cross-sectional study used a self-administered online questionnaire to determine the educational experience and practice of resin infiltration (RI) amongst Paediatric Dentists in Malaysia. Ethics approval for the study was obtained from the Universiti Teknologi MARA ethical committee [FRC/03/2022].

### *Instruments*

The questionnaires were adapted from validated questionnaires developed by Halcomb et al., 2020 (9). Comprising three parts, the first part was designed to collect the background information, general characteristics, educational background, and practice characteristics. Part two gathers information regarding respondents' educational experience with RI and MID, while part three assesses respondents' RI-related attitudes and practices. The questionnaire underwent content validation by two experts in the field of Paediatric Dentistry, who reviewed the questionnaire items based on the study's objectives for clarity and appropriateness. Following the face and content validation process, modifications were done accordingly. A pilot study was then conducted to ascertain the instrument's reliability and the survey participants' comprehension of the questions. Face validation of the questionnaire was performed by distributing the sample questionnaire to ten dental specialists in the field of Paediatric Dentistry and Public Health.

### *Study population and participants' recruitment*

The sample included 110 Paediatric Dental Specialists currently registered under the Malaysian Association of Paediatric Dentistry (MAPD) and Malaysian Dental Council (MDC). The participants included Paediatric dental specialists recognised as specialists and registered under the Malaysian Dental Council and Paediatric Dentistry postgraduate students. The name list and email addresses of Paediatric Dentists were acquired through MAPD. The questionnaire was made using Google Forms and distributed via email. The purpose of the study was clearly outlined in the information sheet. provided to participants, who consisted of paediatric dental specialists and current post-graduate students in Paediatric Dentistry. Responses were collected over a three-month period with reminder emails sent halfway through the survey timeline.

### *Inclusion and Exclusion Criteria*

All participants are required to hold a qualification in Paediatric Dentistry, either as a certified Paediatric Dental Specialist or as a current postgraduate student undergoing training at a recognized Malaysian institution. Participants who do not consent to answer the questionnaire are excluded from the study.

### *Samples size calculation*

A sample size calculation was conducted using a priori power analysis with the program package G*Power 3.1.9.4 to compute the sample size needed, given alpha=0.05, the power=0.95, and a medium to a small effect size of rho=0.30, for testing if there were significant relationships between the respondents' educational experiences and their attitude. This analysis showed that a minimum of 82 subjects are needed to have the power to test the hypotheses.

### *Statistical analysis*

The data were computed and analysed using SPSS (Social Package for Social Science, Chicago, IL, USA) version 26. A descriptive (frequency and percentages) was used to provide an overview of the responses. Pearson's correlation coefficient was conducted to determine the correlation between educational experiences and attitudes in the practice of RI in children.

## *Results*

Out of the 110 members invited to participate, 30 surveys were completed, with a response rate of 27.3%. The sample demographics are summarised in Table 1. The educational experiences subscale comprised 19 items (α=0.84), and the attitude/practice subscale had 11 items (α=0.77).

### *Educational experience related to RI*

A total of 46.7% agreed that their undergraduate training had prepared them well to use RI with paediatric patients whereas 53.3% disagreed their undergraduate training had prepared them well to use RI. A total of 93.4% of respondents felt their training in paediatric postgraduate programs had informed them about using RI, and 80% of the participants agreed that they had been adequately prepared for using RI (Table 2.)

**Table 1:** Participants' personal, professional, and practice characteristics by number and percentage of total respondents (N=30)

| Characteristic | Number | Percentage |
|---|---|---|
| **Gender** | | |
| Male | 6 | 20% |
| Female | 24 | 80% |
| **Age** | | |
| 30 - 35 | 17 | 56.7% |
| 36 - 40 | 9 | 30 % |
| 41 - 50 | 4 | 13.3% |
| **Community location of practice** | | |
| Small town/city (5,000-24,999) | 2 | 6.7% |
| Moderate-sized city (25,000-250,000) | 21 | 70% |
| Large city (>250,000) | 7 | 23.3% |
| **Level of education** | | |
| Paediatric Dentistry Postgraduate Students | 18 | 60% |
| Master's Degree | 11 | 36.7 |
| Doctorate/PhD Degree | 1 | 3.3% |
| **Time since graduation (undergraduate)** | | |
| 1-10 years | 12 | 40% |
| 11-20 years | 18 | 60% |
| **Time since graduation (postgraduate)** | | |
| <5 years | 5 | 41.7% |
| >5 years | 7 | 58.3% |
| **Current practice** | | |
| Private practice | 1 | 3.4 % |
| Government setting | 19 | 63.3% |
| Academic setting | 10 | 33.3% |
| | **Mean** | **SD, Range** |
| Age | 36 | 3.36, 31-45 |
| Year of graduation from undergraduate program | 2011 | 3.67, 2002-2016 |
| Year of graduation from Paediatric Dentistry postgraduate program | 2015 | 3.7, 2010-2021 |

**Table 2:** Respondent's educational experiences related to resin infiltration (RI) by percentage of total respondents (N=30)

| Variable | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | Mean |
|---|---|---|---|---|---|---|
| **Undergraduate Dental school education about RI** | | | | | | |
| a. My classroom-based education in dental school informed me about the use of resin infiltration | 23.3% | 16.7% | 10.0% | 20.0% | 30.0% | 3.17 |
| b. My classroom-based education in dental school informed me about the benefits of resin infiltration | 23.3% | 20.0% | 6.7% | 16.7% | 33.3% | 3.17 |
| c. My clinical education in dental school prepared me well to use resin infiltration with adult patient | 23.3% | 20.0% | 33.3% | 16.7% | 6.7% | 2.63 |
| d. My clinical education in dental school prepared me well to use resin infiltration with paediatric patients | 23.3% | 20.0% | 10.0% | 16.7% | 30.0% | 3.10 |
| e. My instructors in dental school had a positive view of the use of minimally invasive technique | 3.3% | 3.3% | 16.7% | 43.3% | 33.3% | 4.00 |
| f. My instructors in dental school had a positive view of the use of resin infiltration for treating caries | 13.3% | 6.7% | 33.3% | 20.0% | 26.7% | 3.40 |
| **Paediatric Dentistry Postgraduate education about RI** | | | | | | |
| g. My classroom-based education informed me about the use of resin infiltration | 0.0% | 3.3% | 3.3% | 36.7% | 56.7% | 4.47 |
| h. My classroom-based education informed me about the benefits of using resin infiltration | 0.0% | 3.3% | 3.3% | 33.3% | 60.0% | 4.50 |
| i. My clinical education prepared me well to use resin infiltration with adult patients | 10.0% | 6.7% | 23.3% | 43.3% | 16.7% | 3.50 |
| j. My clinical education prepared me well to use resin infiltration with paediatric patients | 3.3% | 0.0% | 16.7% | 33.3% | 46.7% | 4.20 |
| **MID-related educational experiences** | | | | | | |
| k. My instructors in undergraduate dental school had a positive view of the use of minimally invasive procedures for treating caries | 0.0% | 0.0% | 6.7% | 33.3% | 60.0% | 4.53 |
| l. My instructors in paediatric postgraduate program had a positive view of the use of minimally invasive procedures for treating caries | 3.3% | 0.0% | 10.0% | 36.7% | 50.0% | 4.30 |
| **Motivation to learn more about RI** | | | | | | |
| m. I took continuing education (CE) courses about the use of minimally invasive procedures for treating caries | 13.3% | 6.7% | 13.3% | 36.7% | 30.0% | 3.63 |
| n. I took continuing education (CE) courses about the use of resin infiltration | 16.7% | 6.7% | 13.3% | 40.0% | 23.3% | 3.47 |
| o. I would like to take a continuing education (CE) course about resin infiltration | 0.0% | 3.3% | 3.3% | 23.3% | 70.0% | 4.60 |
| p. In the past years, I read articles about the use of minimally invasive procedures for treating caries | 0.0% | 0.0% | 0.0% | 53.3% | 46.7% | 4.47 |
| q. In the past years, I read articles about the use of RI | 0.0% | 3.3% | 3.3% | 50.0% | 43.3% | 4.33 |
| r. In the past years, I have not read any articles regarding RI and MID | 66.7% | 13.3% | 13.3% | 6.7% | 0.0% | 1.60 |
| s. I would like to learn more about the use of resin infiltration... | 0.0% | 0.0% | 0.0% | 30.0% | 70.0% | 4.70 |

**Table 3:** Respondents' attitudes about the use of RI, by percentage of total respondents (N=30)

| Variable | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | Mean |
|---|---|---|---|---|---|---|
| **Positive attitude towards RI** | | | | | | |
| a) The use of resin infiltration has aesthetic benefits | 0.0% | 0.0% | 0.0% | 30.0% | 70.0% | 4.70 |
| b) The use of resin infiltration helps to avoid the use of local anaesthesia with paediatric patients | 3.3% | 3.3% | 33.3% | 33.3% | 26.7% | 3.77 |
| c) The use of resin infiltration helps with the restoration of non-cavitated lesions | 0.0% | 0.0% | 0.0% | 30.0% | 70.0% | 4.70 |
| d) The use of resin infiltration helps to prolong the life expectancy of a tooth | 0.0% | 0.0% | 23.3% | 33.3% | 43.3% | 4.20 |
| e) The use of resin infiltration helps me to prevent dental fear in my patients | 0.0% | 3.3% | 30.0% | 33.3% | 33.3% | 3.97 |
| f) The use of the resin infiltration technique is useful in my practice (or can be) | 0.0% | 3.3% | 6.7% | 43.3% | 46.7% | 4.33 |
| **Negative attitudes towards RI** | | | | | | |
| h) I don't believe in minimally invasive dentistry... | 80.0% | 13.3% | 3.3% | 3.3% | 0.0% | 4.70 |
| i) Resin infiltration is a trend that will disappear again... | 50.0% | 30.0% | 16.7% | 3.3% | 0.0% | 4.27 |
| j) It is not practical for me to use resin infiltration... | 46.7% | 30.0% | 13.3% | 6.7% | 3.3% | 4.10 |
| k) Resin infiltration is only of value in orthodontic practices | 63.3% | 26.7% | 6.7% | 3.3% | 0.0% | 4.50 |
| **Responses related to RI use** | | | | | | |
| | **No** | **Neutral** | **Yes** | | | |
| I would consider implementing RI in my clinic | 0% | 10% | 90% | | | |
| The fact that resin infiltration does not show up on x-rays is a problem for me | 3.3% | 23.3% | 46.7% | 20.0% | 6.7% | 3.03 |
| Frequency of use | Never | Rarely | Often | Very often | | Mean |
| How often do you use resin infiltration in your own work? | 20.0% | 63.3% | 16.7% | 0.0% | | 0.97 |

**Table 4:** Correlation between knowledge and attitude to practice RI (N=30)

| ***Variables*** | ***Attitude*** |
|---|---|
| *Knowledge* | *0.460* |

**p > 0.05*

### *Motivation to learn more about RI*

Around two-thirds (66.7%) of surveyed dental professionals had taken continuing education courses about RI. Most participants (93.3%) indicated reading published scientific articles regarding RI. Most respondents wanted to learn more about RI (100%) and to take a continuing education course (93.3%).

### *Attitudes on the usage of RI*

As shown in Table 3., 100% of the participants agree with the aesthetic benefits of RI. 90% of the participants feel that RI is useful/ can be useful in their practice. Half of the participants are unsure that the fact that the RI does not show up on the radiograph will be a problem. Around 60% of the participants feel that RI avoids the use of local anaesthesia.

### *Practice of RI*

Around two-thirds of the respondents (63.3%) rarely use RI in their practice, while 20% have never used it. Among the respondents, 73.3% have used RI in the past. 90% would consider implementing RI in their clinic.

### *Pearson correlation test*

To assess the size and direction of the linear relationship between educational experiences and attitudes, a bivariate Pearson's product-moment correlation coefficient (r) was calculated. The bivariate correlation between these two variables was positive but not significant, r (30) = 0.140, p= 0.460 (Table 4). There were no statistically significant correlations between the educational experiences (knowledge) and the attitude of using RI ($p > 0.05$).

## *Discussion*

### *Statement of principle findings*

This study assessed the educational experiences, attitudes, and practice of resin infiltration amongst Malaysian Paediatric Dental Specialists and post-graduate students in Paediatric Dentistry. This study targeted the Paediatric Dental Specialist and post-graduate students as they mostly manage children. The author would like to assess the educational experiences and current use of RI in this group. Based on the findings of the respondents' RI-related educational experiences, it was evident that RI was not covered well in their undergraduate dental program as compared to their postgraduate training program. This finding is similar to the study done by Halcomb et al., where RI also found RI was not covered well in undergraduate training as compared to their residency program (9). The respondent felt that their postgraduate dental training taught them and prepared them better for using RI. This is likely due to the recent gain in popularity of this technique and the increased awareness amongst dentists to practice minimally invasive dentistry. Moreover, the proven clinical success of RI in managing caries in paediatric patients (10–12) has increased its use. However, due to the high cost of RI material, it is mostly available for the specialists and post-graduate students to use compared to the undergraduate dental clinic.

It is important to note that 100% of the respondents expressed a desire to learn more about RI, and 93.3% expressed a desire to enrol in continuing education courses. This suggests that despite receiving comprehensive postgraduate training it is possible that the training is inadequate for them to gain confidence in practising. This calls for dental schools to strengthen their training in resin infiltration at both the undergraduate and postgraduate levels. Even though most respondents positively view RI, only a few uses it in their practice. RI has emerged as a crucial micro-invasive technique for managing non-cavitated and white-spot enamel lesions in children and adolescents. Despite its significance, concerns have been raised regarding radiopacity, colour stability, and its application in deep dentinal lesions. Ongoing active efforts are being made to enhance the current RI, with a focus on addressing clinical issues associated with the material. However, it's noteworthy that most studies are currently laboratory-based, potentially yielding different clinical outcomes. Consequently, additional research through clinical trials is essential for a comprehensive understanding (13).

### *Strength and weaknesses of the study*

This is the first study conducted in Malaysia to evaluate the educational experiences, attitudes, and practice of resin infiltration (RI) amongst Malaysian Paediatric Dentists and to determine the relationship between their educational experiences and attitudes in the practice of RI in children. A similar study was conducted in the USA explored paediatric dentists' knowledge, attitude, and practice of RI and its implication for dental education (9). Many other studies have investigated knowledge, attitude and practice in minimally invasive dentistry in general

(14–16), therefore a direct comparison cannot be made. Studies conducted specifically on the knowledge, attitude and practice of RI are scarce. Hence, this study is essential to assess the current RI practice amongst paediatric dentists and to elucidate its implication for dental education. It indirectly sheds light on the present teaching of RI at the undergraduate and postgraduate levels. Results from this study may be helpful in Malaysia's national dental undergraduate curriculum assessment and curriculum design.

According to the G-power analysis, data from 82 respondents were necessary to have the power to determine the presence of a positive relationship between the respondent's RI-related educational experiences and RI-related attitudes. In this study, data from 30 respondents were collected. The low sample size has resulted in the inability to test hypotheses about the relationship between educational experiences and attitudes in using RI. This study found no correlation between education experiences and attitude in using RI. All 110 respondents were invited to participate via e-mail after obtaining permission from the Malaysian Association of Paediatric Dentistry, where all of them are registered. Reminder emails were sent after receiving a low response rate. One of the possible reasons for the inadequate response is likely due to the lengthy questionnaires. In addition, this research is only focused on a group of population which is the Malaysian Paediatric Dentist and post-graduate students. This could be the reason for the low sample size.

Despite no relationship found between educational experiences and attitude in the practice of RI, educators in dental schools at the undergraduate and postgraduate levels should be knowledgeable about the currently available evidence regarding the benefit of using RI. This is a preliminary study to gauge the current use of RI amongst paediatric dentists in Malaysia. However, there is a need for a more comprehensive analysis to investigate the possible barriers to teaching and utilising RI. Understanding these factors could help solve the issues faced by clinicians and increase the knowledge and use of RI among Malaysian Dentists in general. Further studies should be conducted to survey dental schools to get a clearer picture of the undergraduate curriculum in the teaching of RI.

## *Conclusion*

Malaysian paediatric dentists and post-graduate students have positive attitudes toward using resin infiltration; however, this study showed that the educational experience in undergraduate dental program is lacking hence the need to incorporate RI into the dental curriculum. Furthermore, expanding undergraduate, postgraduate, and continuing professional education in RI should be strengthened.

## *Competing interests*

The authors declare that they have no competing interests.

## *Financial support*

No funding was received for this work.

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