Case Study

Awareness of Using the Resin Infiltration Material Among Dental Practitioners in Saudi Arabia: A Cross-Sectional Study

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Abstract

Resin infiltration (Icon) low-viscosity light-curing resins that are designed for quick penetration into porous enamel to treat a different demineralized enamel defect, infiltration procedure that was created for the management of incipient caries has been applied in the treatment of dental fluorosis as well. The aim of this study was to assess whether dental practitioners in Saudi Arabia have sufficient knowledge level of the uses of resin infiltration in minimally invasive dentistry. The study was an observational cross-sectional with a questionnaire online survey, in Saudi Arabia about the uses of resin infiltration in minimal intervention dentistry in 2022. This study was done at a 95 % confidence interval, and a 5 % margin of error, with the total sample size well estimated to be 384. Data was entered and analyzed by "Microsoft Office Excel software" program (2016) for windows. Regarding knowledge about resin infiltration, 21.5% of the participant had a high level of knowledge, 68.7% had a moderate level of knowledge, and 9.9% had a low level of knowledge. Concerning practicing, 46.3% of the participants had a good practice, 51.1% had a fair level of practice, and only 2.6% had a poor level of practice. It can be concluded from the findings that the knowledge of dental professionals regarding the practice of Resin Infiltration is not satisfactory, only 21.5% out of 536 participants had a high level of knowledge, and 46.3% had a good practice.

Keywords: Resin infiltration, Minimal intervention dentistry, Icon, Saudi Arabia

Introduction

Resin infiltration (Icon) has consistently been incorporated into modern treatment techniques, it is considered a unique micro-invasive procedure that involves filling, reinforcing, and protecting demineralized enamel. It also slows the progression of enamel demineralization and enhances its aesthetics [1]. Resin infiltration (ICON) is considered the most conservative method for managing enamel opacities cosmetically, it does not require tooth structure removal nor local anesthesia. By infiltrating low-viscosity light-curing resins that are designed for quick penetration into porous enamel, this treatment seeks to prevent the microporosities inside the lesion body [2, 3]. In addition, resin infiltration can mask white spot lesions (WSL), the microporous enamel areas of non-cavitated initial carious lesions, and lesions associated with fixed orthodontic appliances [4].

Resin infiltration (ICNO), which involves three steps of etching with 15% hydrochloric acid, drying with an ethanol solution, and applying TEGDMA-based resin infiltration into the porous enamel, it seemed to be a promising technique in minimal intervention dentistry [5-8]. that inhibited the demineralization and mechanically stabilizes the demineralized lesions. Also, demonstrated to increase the microhardness of demineralized dental hard tissues

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significantly and reduce mineral loss. ICON resin infiltration was introduced in 2009, by DMG HAMBURG, GERMANY can treat several problems like incipient caries, primary caries, and secondary caries [9]. infiltration procedure that was created for the management of incipient caries has been applied in the treatment of dental fluorosis as well [10].

In 2019, a study was conducted which showed that proximal resin infiltration is more effective than traditional care modalities at slowing or arresting the advancement of proximal carious lesions (NCPLs) [11]. In a 2020 published study, 59.1% of patients have white spot lesions (WSLs) and 40.9% of patients had fixed orthodontic treatment, all patient appears According to the investigation's finding immediately effective and long-term color stability between the two groups used resin infiltration [12]. A survey was conducted in 2019 to evaluate the penetration depth, surface roughness, and color stability of resin infiltration, and the result has shown that the depth of resin penetration was more with enamel lesions of primary teeth compared to permanent teeth, resin infiltrated enamel did not show alteration in surface roughness compared to the sound enamel and also enamel showed color stability over eight weeks duration [13]. There're a few numbers of studies that assess the knowledge level and practice of resin infiltration among dentists in Saudi Arabia. in our study, we are going to assess the awareness of dental students, dental interns, and dental practitioners in KSA.

Materials and Methods

Objective

The aim of this study was to assess whether dental practitioners in Saudi Arabia have sufficient knowledge level of the uses of resin infiltration in minimally invasive dentistry.

Study Design

The study was an observational cross-sectional with a questionnaire online survey, to evaluate the level of knowledge and practices of dental practitioners in Saudi Arabia about the uses of resin infiltration in minimal intervention dentistry. The study participants consisted of undergraduate dental students, dental interns, and all dentists practitioners in KSA.

Inclusion and Exclusion Criteria

The study population consisted of all dentists in KSA including dental students, dental interns, and dentists' workers GP and specialists.

Sample Size

This study will be done at a 95 % confidence interval and a 5 % margin of error. The sample size was determined using N=$z2p\frac{1-p}{d2}$ $(kish\ 1965\ Formula)$ Z= 1.96 when $\alpha =$ 0.05 p= proportion of the estimated knowledge d= precision of the estimate (error margin)

So, the calculated minimum sample size was N= $(1.96)2 \times 0.50 \times 0.50 \div (0.05)2 = 384$. Plus a 20 percent non-response rate, the total sample size was estimated to be 464.

Method for Data Collection and Instrument (Data Collection Technique and Tools)

A self-administration online questionnaire developed by reviewing literature conducted on 20 questions. The questionnaire was made up of three sections, the first section was demographic items, the second section was knowledge items, and the third section was practice items that will be used to collect the data.

Part 1: knowledge regarding uses of resin infiltration
There were 7 questions in this part, which will be asking about the knowledge level of uses resin infiltration in minimally invasive dentistry.

The total scoring is 14 points, each question has three choices, scores Agree = 2, undecided =1, disagree =0. A score will get above 10 will consider a high level, a score between 6-10 will considering moderate, score below 6 will consider a low level of knowledge.

Part 2: Practice regarding uses of resin infiltration
In practice section 8 questions are included. all the questions have a positive statement. The rating scale will be measured as follow: statement with yes score =2, I don't know = 1, no=0.

The total score is 16 points, the scores will get above 10 will considering a good level, scores between 10-6 points will consider fair, and scores below 6 will be considered a poor level of practice.

Pilot Test

The questionnaire was distributed to 20 people and had them fill it out. This was done to test the simplicity of the questionnaire and the feasibility of the study. Data from the pilot studies were excluded from the final study data.

Analyzes and Entry Method

All the data collected has been entered, tabulated, and analyzed by "Microsoft Office Excel" software" program (2016). The questionnaires were weighted to check the accuracy of the data that was entered by the data clearing and exploration method in the database.

Results and Discussion

Table 1 Shows the sociodemographic characteristics of the studied population. The total number was 536, of which, 49.8% were males, and 93.1% were Saudi. 41.8% of the participants were undergraduate student dentists in clinical

practice, 23.0% were interns, and 12.9% were dentists with more than 4 years of clinical experience.

Table 2 Shows the attitude of participants towards using resin infiltration in minimally invasive dentistry. 64.7% thought they have well heard about resin infiltration material, and 26.7% thought they were fully aware of it. On the contrary, 17.3% had no interest in this topic before.

Figure 1, shows the knowledge score results among our participants. 21.5% of the participant had a high level of knowledge, 68.7% had a moderate level of knowledge, and 9.9% had a low level of knowledge.

Table 4 shows practice score results. 46.3% of the participants had a good practice, 51.1% had a fair level of practice, and only 2.6% had a poor level of practice.

Table 5 shows the Relation between the sociodemographic characteristics of the studied population and their knowledge and practice scores, respectively. There was a significant relationship between the level of knowledge and practice, and the years of clinical experience (p-value = 0.032), unlike gender and nationality (p-value = 0.06), (p-value = 0.531), respectively. We have also found a significant relationship between the level of knowledge and practice, and education qualification (p-value = 0.023).

Table 1. Sociodemographic characteristics of participants (n=536)

Parameter		No.	%
Gender	Male	267	49.8
	Female	269	50.2
Nationality	Saudi	499	93.1
	Non-Saudi	37	6.9
Years of clinical experience	Undergraduate students clinical	175	32.6
	One year	113	21.1
	Two years	70	13.1
	Three years	64	11.9
	Four years	45	8.4
	More than 4 years	69	12.9
Educational Qualification	Dental intern	123	23.0
	Dental student	224	41.8
	Graduate	150	28.0
	Postgraduate	39	7.3
Residence region	Central Region	99	18.5
	Eastern Region	72	13.4
	Northern region	98	18.3
	Southern region	208	38.8
	Western Region	59	11.0

Table 2. Attitude of participants towards using resin infiltration in minimally invasive dentistry (n=536).

Parameter		No.	%
Heard well about the resin infiltration material	Agree	347	64.7
	Disagree	66	12.3
	Undecided	123	22.9
Evaluate knowledge regarding resin infiltration material	Fully aware	143	26.7
	I have some idea	300	56.0
	Had no interest in this topic before	93	17.3

Table 3. Questions of a score of knowledge of participants of using resin infiltration in minimally invasive dentistry (n=536).

	Agree	Undecided	Disagree
15% hydrochloric acid the beat etching for resin infiltration material	287 53.5%	206 38.4%	43 8.0%
120 seconds of an etching by 15% hydrochloric acid is enough for using resin infiltration material	237 44.2%	240 44.8%	59 11.0%
It is essential to use an icon dry syringe during the recreation steps	231 43.1%	249 46.5%	56 10.4%
In resin infiltration we use low-viscosity trimethylene glycol dimethacrylate (TEGDMA) based resin	264 49.3%	233 43.5%	39 7.3%
The resin infiltration depends on its penetration coefficient (PC) to get the effect	248 46.3%	245 45.7%	43 8.0%

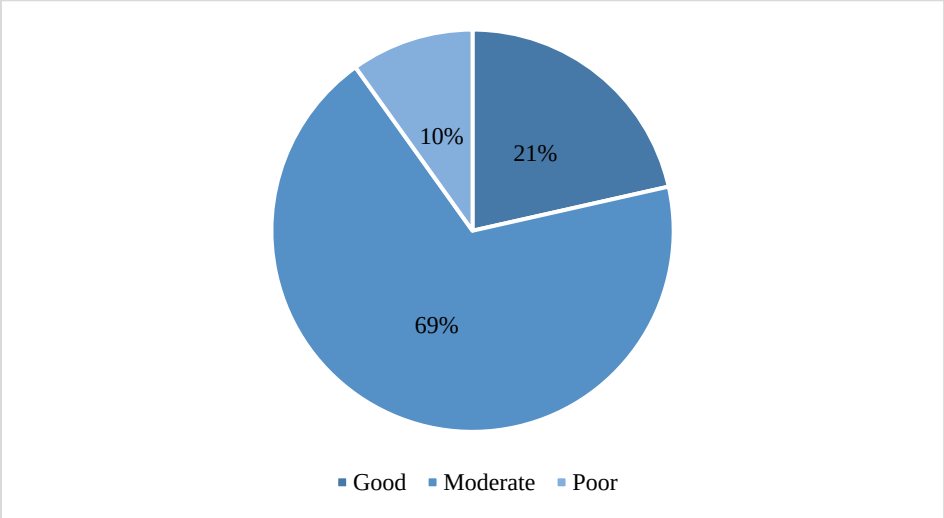

Figure 1. Illustrates the knowledge score results regarding using resin infiltration in minimally invasive dentistry. (n=536).

Table 4. Questions of practice score of participants towards using resin infiltration in minimally invasive dentistry.

	Yes	No	Don't know
Is the resin infiltration technique considered effective to treat white spots lesion and enamel opacities?	334 62.3%	73 13.6%	129 24.1%
Do you believe that resin infiltration can effectively mask mild to moderate dental fluorosis?	314 58.6%	85 15.9%	137 25.6%
Does the resin infiltration have a significantly higher masking effect against the hypomineralization area after ortho treatment?	272 50.7%	82 15.3%	182 34.0%
Is resin infiltration considered to be effective against early proximal caries?	197 36.8%	134 25.0%	205 38.2%
The resin infiltration technique provided a conservative and inexpensive treatment for incipient caries.	230 42.9%	113 21.1%	193 36.0%
Resin infiltration is a safe and efficient treatment option for masking developmental defects in enamel?	245 45.7%	98 18.3%	193 36.0%
Do you require more training regarding resin infiltration?	336 62.7%	79 14.7%	121 22.6%
Do you consider resin infiltration to have equal esthetic results compared with dental restoration?	251 46.8%	122 22.8%	163 30.4%

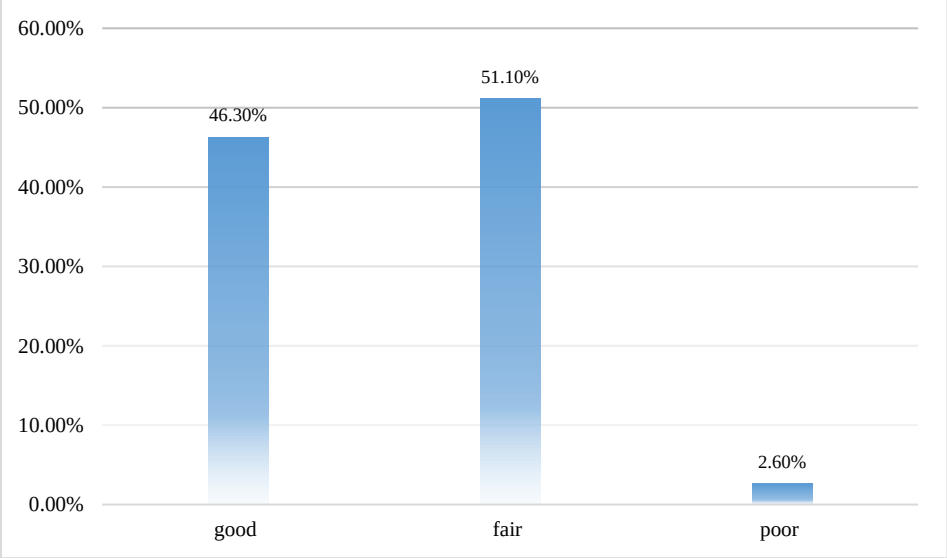

Figure 2. Practice score results, (n=536).

Table 5. Relation between sociodemographic characteristics of the studied population and their knowledge and practice scores, respectively. (n=536).

	P value	P value
	Knowledge scores	**Practice Score**
Gender	0.549	0.060
Nationality	0.346	0.531
Years of clinical experience?	0.074	0.032
What is your educational qualification?	0.004	0.024
Region	0.103	0.087

Proximal dental caries is a significant health problem primarily affecting the younger age groups [14]. This is usually associated with the difficulty of cleaning proximal surfaces compared to other smooth surfaces, and the high patient involvement required to maintain sparse proximal hygiene practices which might be sparse in such an age category. Aggravating the problem, using rotary burs, and cutting instruments in the conventional invasive treatment of proximal lesions sacrifice substantial amounts of sound tooth structure [15].

Resin infiltration RI is a novel carious lesion arrest technique that offers a new intermediary treatment for preventive and restorative therapy. With this treatment, the resinous material plugs the porosities within the lesion. The resin fills the pores within the tooth and stops the progression of caries [16]. The special resins, optimized for rapid capillary diffusion, penetrate to significant depths. Resin infiltration works on the principle of perfusing the enamel pores with resin by capillary forces rendering the white spots negligible because the refractive index of porous enamel becomes nearly similar to that of healthy enamel (1.52). Recently, RI has also been described in the esthetic management of fluorosis stains [17]. The rationale for using resin infiltrant in fluorosis spots is that these lesions imitate white spot demineralization since they already have a hypomineralized enamel subsurface under a relatively well-mineralized area that can be easily penetrated by the resin [18]. A scientific study found that carries lesions proximal to permanent teeth were less likely to progress after treatment compared to non-invasive methods (oral hygiene instruction), with resin infiltrant and oral hygiene measures [19]. A recent meta-analysis showed that preventing the progression of non-cavitated caries lesions by using resin infiltration is promising; thus, resin infiltration is proposed as an encouraging non-invasive approach that can be used as an option in addition to non-operative and operative treatment approaches [20].

This study aimed to assess whether dental practitioners in Saudi Arabia have sufficient knowledge level of the uses of resin infiltration in minimally invasive dentistry. In our study we found that the knowledge score among our participants was 21.5% out of 536 participants had a high level of knowledge, 68.7% had a moderate level of knowledge, and

9.9% had a low level of knowledge. Regarding practice scores, we have found that 46.3% had a good practice, 51.1% were fair, and 2.6% had a poor level of practice.

Regarding the relation between sociodemographic characteristics of the studied population and their knowledge and practice scores, we have found a significant relationship between the level of knowledge and practice, and the years of clinical experience (p-value = 0.032), unlike gender and nationality (p-value = 0.06), (p-value = 0.531), respectively. We have also found a significant relationship between the level of knowledge and practice, and education qualification (p-value = 0.023).

In a study among dental practitioners conducted to assess the knowledge and attitude of practitioners in Karnataka, India, 97% of respondents were aware of the principles of preventive dentistry and 90.7% of the respondents possessed knowledge about the re-mineralization of initial lesions instead of using surgical procedures on the prognosis of caries [21].

Another study conducted in Riyadh and AlKharj [22], to assess the knowledge and attitude among general dental practitioners towards minimally invasive dentistry as resin infiltration, revealed that age and gender did not seem to affect the knowledge possessed about MID. However, experience within the practice seemed to increase awareness about MID knowledge of the GDPs, which is consistent with our results. It was observed that more than half (51.5%) of the respondents either had no knowledge or only possessed little knowledge about MID.

Another study conducted in Riyadh, KSA [23], to determine the level of knowledge regarding Resin Infiltration among Riyadh-based Saudi dentists, and revealed that the overall knowledge reported by the participants regarding Resin Infiltration was 25.2% poor, 72.9% moderate, and only 1.9% excellent. 64% of dental professionals knew that RI is a micro-invasive procedure.

A retrospective clinical study on the resin infiltration [24] showed that treatments performed by the non-trained dentists were 2.5-fold-more-likely-to-present caries progression than the non-trained undergraduate dental students working under supervision, while no significant difference was found between the non-trained undergraduate dental students working under the supervision and the trained dentists. One could speculate that treatments performed by non-trained undergraduate dental students would be more prone to failure, as the quality of treatment is expected to improve with the operators' clinical experience.

Conclusion

Resin infiltration RI is a novel technology for arresting caries lesions, providing a new intermediary treatment choice between preventive and restorative therapies. It can be concluded from the findings that the knowledge of dental professionals regarding the practice of Resin Infiltration is not satisfactory, only 21.5% out of 536 participants had a high level of knowledge, and 46.3% had a good practice.

The operator's experience and training could influence the success of RI on proximal non-cavitated caries lesions and it should be taken into consideration when choosing this treatment modality. Gender and nationality did not affect knowledge and practice scores.

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