Case Study

COGNIZANCE OF ASSESSMENT AND TREATMENT THE DEEP MARGINAL RESTORATION AMONG DENTAL INTERNS AND GENERAL PRACTITIONERS: KSA

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ABSTRACT

In 1993, a new technique was introduced by Dietschi and spreading known as cervical margin relocation (CMR), proximal box elevation (PBE), or Deep margin elevation (DME). This technique's benefit is making the clinical work more straightforward with less failure rate. Our study was designed to assess the knowledge, attitude, and practice of deep-margin elevation procedures among dental interns and general dentists in Saudi Arabia. This cross-sectional study was conducted in Saudi Arabia for six months between July 2022 to August 2023. The questionnaire section's design followed the (KAP) to assess and measure the population's knowledge, attitude, and practice. In this cross-sectional survey. The collected data was exported to "Microsoft Office Excel Software". The statistical analysis was done through the (SPSS) Software. The study included 407 participants, 50.4% of them were females and 49.6% of them were males. 97.3% of study participants were Saudi. 61.9% were medical interns and 38.1% were general dentists. 83.3% of participants had heard of deep margin elevation before and 16.7% didn't hear of it. 63.6% of participants had good KAP scores, 27.3% had moderate KAP, and 9.1% had low KAP towards deep margin elevation. KAP scores were only associated with participants' nationality (P= 0.020). In conclusion, participants show moderate knowledge, attitude, and practice scores toward DME. As an alternative to surgical crown lengthening, it is advised that dental professionals implement this approach in their dental clinics.

Key words: Deep marginal elevation, Attitude, Knowledge, Proximal box, Deep margin, Cervical margin relocation.

Introduction

One of the most common scenarios clinicians face daily in their practice is deep proximal cavities where caries extend close to or below the cement-enamel junction (CEJ) [1]. Various approaches are proposed to gain access to the margins of the subgingival cavities and restore them, if necessary, which include surgical crown lengthening (CL). However, this approach is invasive and requires time for healing [2, 3].

Dietschi *et al*. In 1993 a novel, non-invasive, more simplified procedure known as deep margin elevation (DME). Additionally, it is also called cervical margin relocation (CMR), proximal box elevation (PBE), and margin elevation technique (MET) [2-5]. The DME technique is done by adding an increment of composite resin onto the existing margin. This is done after elevating the deep dentinal cervical preparation supragingival by using a metal matrix band [6, 7].

One of the challenges of a conservative approach is establishing its boundaries and recognizing exactly what scenarios necessitate modifying the tissue form around a tooth to restore it, or extracting a tooth instead of repairing it [4].

In deep-margin cases the sandwich technique can be used, this technique combines the layering of various materials to create desirable properties. It can be performed in either an open or a closed manner [8-11]. The closed sandwich technique uses a layer of GIC as a liner to cover the exposed dentine before proceeding with a layer of composite. Furthermore, this technique can be used with other materials, such as resin-modified glass ionomer cement (RMGIC), Theracal LC, Biodentine, and flowable composites [12, 13]. A closed sandwich technique utilizing resin-modified glass ionomer (RMGIC) possesses several desirable characteristics, which include chemical bonding to teeth and micromechanical bonding to composite, enhanced biocompatibility, fluoride release, and increased marginal

integrity [14]. Despite the effectiveness of the closed-sandwich technique in reducing leakage, limited access to a cavity may make it difficult to properly place the glass-ionomer cement [15].

In 1977, the open sandwich technique was first described by McLean and Wilson, in this technique the glass ionomer cement is exposed to the oral cavity so it allows the release of fluoride to surrounding tooth structure and protects them [12].

Zaruba M *et al*; Carried out a study that assessed the effect of DME on the marginal integrity of ceramic inlay. It showed no difference in the marginal adaptation of teeth treated with DME from margins of ceramic inlays placed on dentin [8]. In 2021, Alahmari N *et al*. Stated that the CMR technique with resin luting cement of lithium disilicate crowns is reliable and recommended for the restoration of deep class II premolars or posterior teeth [9].

Ferrari M *et al*. In 2018 the effect of deep marginal elevation (DME) on periodontal health. It concluded that BOP is more likely to occur around teeth treated with DME and deep margins located at or near the crestal bone [10].

A recent study done in Riyadh, Saudi Arabia 2021, assessed the Knowledge, attitude, and practice regarding (DME) among dental practitioners. Showed that only 30.4% used this technique in their practice. Consultants use it less frequently than general dentists. Participants agreed that bonding to deep cervical dentine is predictable and related to restoration success [2].

This study was performed, due to the insufficient number of studies related to this topic, especially in Saudi Arabia, in addition to the need for a greater sample size. Our study was designed to assess the knowledge, attitude, and practice of deep-margin elevation procedures among dental interns and general dentists in Saudi Arabia.

Materials and Methods

Study design and setting
This is a cross-sectional questionnaire survey, based on a structured questionnaire carried out for six months between July 2022 to August 2023 in Saudi Arabia.

Sample size
In this cross-sectional survey, A sample size calculation was done by (the Raosoft sample size calculator program)—the marginal error setting at the most common value of 5%. The selection of response distribution of the population at the calculating formula was selected to be 50%. The confidence level settings were chosen to be at 95%—the result of the calculation with a minimum of 377 population size.

Inclusion and Exclusion criteria
Inclusion criteria included dental interns, general dentists, male, and female, working in Saudi Arabia, and working in the private or government sector.

Exclusion criteria included specialists, consultants, and those not working in Saudi Arabia.

Method for data collection and instrument (Data collection Technique and tools)
The questionnaire section's design followed the (KAP) to assess and measure the population's knowledge, attitude, and practice. Therefore, section (I) was collecting the participant's demographic data after agreeing to participate. Section (II) assesses the target population's knowledge about the deep marginal elevation procedure. These questions have a Scoring system where (Yes) has 1-points, and (No) has 0-points.

Section (III); the scoring system was between 1 and 4 points to assess the awareness level. For that, the point distribution on each answer was: "Strongly Disagree" has 0-point, "Disagree" has 1-point, "Not Sure" has 2-point, "Agree" has 3-point, and "Strongly Agree" has 4 points. Section (IV); to assess the practice level, the points distribution (5-4-3-2-1-0) was applied to the answer "always," "mostly," "sometimes," "rarely," and "never," respectively.

All the applied questions were entered through a Google form link and distributed online through email and social media.

Results and Discussion

The study included 407 participants, 50.4% of them were females and 49.6% of them were males. 97.3% of study participants were Saudi. 61.9% were medical interns and 38.1% were general dentists. 41.3% work in governmental hospitals, while 22.9% work in private hospitals. As for experience, 62.7% of participants were fresh graduates and had no experience, 10.3% had one year of experience, and 9.3% had two years of experience.

Table 1. Sociodemographic characteristics of participants (n=407)

Parameter		No.	%
Gender	Male	205	50.4
	Female	202	49.6
Nationality	Saudi	396	97.3

	Non-Saudi	11	2.7
Region	Central	51	12.5
	Eastern	46	11.3
	Northern	58	14.3
	Southern	129	31.7
	Western	123	30.2
Current Position	Dental intern	252	61.9
	General Dentist	155	38.1
Workplace	Government	168	41.3
	Private	93	22.9
	unemployed	146	35.9
University	BMC	12	2.9
	IABFU	4	1.0
	Ibn since	11	2.7
	King Abdelaziz university	114	28.0
	King Faisal university	5	1.2
	king Khalid university	130	31.9
	king Saud university	12	2.9
	Others	70	17.2
	Prince Sattam University	5	1.2
	Princess Nora Bint Abdulrahman University	6	1.5
	Riyadh Elm University	16	3.9
	Taibah University	9	2.2
	Taif university	1	.2
	Umm Al-Qura University	3	.7
	Vision college	9	2.2
Years of experience	1 year	42	10.3
	2 years	38	9.3
	3 years	35	8.6
	4 years	14	3.4
	5 years and More	23	5.7
	Fresh graduates	255	62.7

As illustrated in **Figure 1**, 83.3% of participants had heard of deep margin elevation before and 16.7% didn't hear of it.

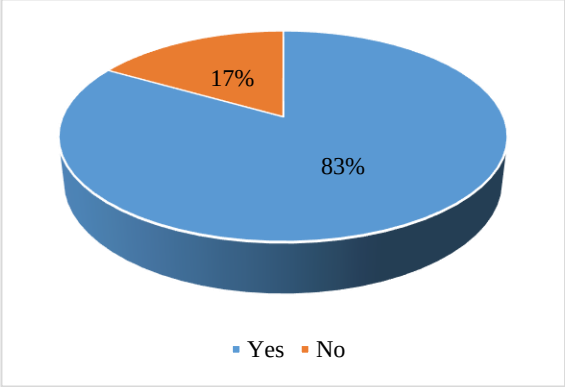

Figure 1. Participants heard of deep margin elevation (n= 407)

Table 2 shows that 39.8% of participants used the technique before. 71.3% of participants agreed that adhesive bonding to deep cervical dentin is predictable and related to the success of the final restoration. 53.6% agree that fracture resistance was compromised in the case of deep margin elevation. 69.3% agree that surgical apical displacement of the tooth-supporting tissues to expose the gingival margins may lead to complications such as attachment loss. 78.9% agree that the space between the margin and the alveolar crest (biological width) is a factor that should be known before deciding to use DME. 35.4% of participants chose RMGEC as the best material used with the closed sandwich technique.

Table 2. Participants knowledge and attitude towards deep margin elevation (n=407)

Parameter		No.	%
Used the technique before	Yes	162	39.8
	No	245	60.2
Adhesive bonding to deep cervical dentin is predictable and related to the success of the final restoration	Agree	290	71.3
	Disagree	55	13.5
	I don't know	62	15.2
There are no differences in the marginal adaptation of the restorations placed directly on subgingival (deep) margins.	Agree	90	22.1
	Disagree	244	60.0
	I don't know	73	17.9
Fracture resistance was compromised in the case of deep margin elevation.	Agree	218	53.6
	Disagree	77	18.9
	I don't know	112	27.5
Type of radiograph should be taken to evaluate the adaptation at the gingival area	Bitewing radiograph	333	81.8
	Panoramic radiograph	35	8.6
	Periapical radiograph	39	9.6
Surgical apical displacement of the tooth-supporting tissues to expose the gingival margins may lead to complications such as attachment loss.	Agree	282	69.3
	Disagree	42	10.3
	I don't know	83	20.4
DME should be performed	After endodontic treatment	122	30.0
	Before endodontic treatment	197	48.4
	I don't know	88	21.6
The space between the margin and the alveolar crest (biological width) is a factor that should be known before deciding to use DME.	Agree	321	78.9
	Disagree	25	6.1
	I don't know	61	15.0
Minimum standard biological width to be applicable for any procedure	0.5 mm	39	9.6
	1 mm	64	15.7
	2 mm	259	63.6
	I don't know	45	11.1
The most recommended restoration margin for performing a safe and clean bonded indirect restoration for posterior teeth	Equigingival	85	20.9
	Subgingival	26	6.4
	Supragingival	241	59.2
	I don't know	55	13.5
On which teeth is DME most preferably performed	Anterior teeth	30	7.4
	Posterior teeth	225	55.3
	Both	79	19.4
	I don't know	73	17.9
The most frequent type of restorative materials used during DME procedure	Flowable composite	100	24.6
	Glass ionomer cement	150	36.9
	Packable composite	110	27.0
	others	47	11.5
The best material used with the closed sandwich technique	Biodentine	80	19.7
	Flowable composite	34	8.4
	GIC	68	16.7
	RMGIC	144	35.4

	I don't know	81	19.9
Scenarios would benefit from using the closed sandwich technique instead of the open sandwich technique	Class II not extending to the CEJ (cementoenamel junction)	143	35.1
	Class III not extending to the CEJ (cementoenamel junction)	30	7.4
	Deep class 5 extending to the CEJ (cementoenamel junction)	129	31.7
	I don't know	105	25.8

The data provided in **Table 3** presents the parameters and percentages of various treatment options for four different cases involving dental issues. These cases involve patients of different ages and genders, each with their unique dental concerns.

In the first case, a 51-year-old male presented with constant pain in the lower left molar area. The examination revealed caries affecting tooth 36, along with an additional canal in the distal root. The tooth was diagnosed with irreversible pulpitis, and root canal treatment was planned. The options for treatment included crown lengthening, deep margin elevation (DME), extraction, final restoration without any additional procedures, and gingivectomy. Among these options, final restoration without any additional procedures was the most common choice, selected by 62.7% of patients.

The second case involved a 53-year-old female who complained of pain associated with chewing in the left lower molar area. Clinical examination showed that tooth 36 was sensitive to percussion, and radiographic examination revealed apical radiolucency at the distal root. The tooth was diagnosed with acute apical periodontitis, and the margin was located within the gingival sulcus. The treatment options included crown lengthening, DME, extraction, final restoration without any additional procedures, and gingivectomy. The most common choice among these options was deep margin elevation, selected by 56% of patients.

In the third case, a 33-year-old female presented with complaints in the right maxillary molar area. Radiographic examination showed secondary mesial caries in tooth 17 under an old amalgam restoration, as well as caries in the mesial of tooth 16. The tooth 17 was diagnosed with irreversible pulpitis, and the margins of the healthy tissue in the cavity were found to be completely subgingival. The treatment options included crown lengthening, DME, extraction, final restoration without any additional procedures, and gingivectomy. Among these options, crown lengthening was the most common choice, selected by 31.7% of patients.

The fourth case involved a 55-year-old female who complained of acute pain in the right mandibular molar area. The periapical radiograph showed an extensive class II restoration of tooth 46, with secondary caries reaching the bone crest and the pulp chamber. The tooth was diagnosed with irreversible pulpitis, and the distal margin of the cavity was completely at the bone level. The treatment options included crown lengthening, DME, extraction, final restoration without any additional procedures, and gingivectomy. Extraction was the most common choice among these options, selected by 32.2% of patients.

Table 3. Participants' Practice Towards deep margin elevation (n= 407)

Parameters		**No.**	**%**
A 51-year-old male otherwise healthy presented to the dental clinic with a chief complaint of constant pain in the lower left molar area. The clinical and radiographic examination revealed occlusal-distal caries affecting tooth 36. An additional canal in the distal root had been observed. The tooth was also diagnosed with irreversible pulpitis and root canal treatment was planned. Upon preparation, the distal cavity margin was above the gingival sulcus.	Crown lengthening	17	4.2
	Deep margin elevation (DME)	97	23.8
	Extraction	9	2.2
	Final restoration without any additional	255	62.7
	Gingivectomy	29	7.1
A 53-year-old female otherwise healthy, presented to the dental clinic with a chief complaint of pain associated with chewing in the left lower molar area. Clinical examination indicated that tooth 36 was sensitive to percussion. Radiographic examination showed apical radiolucency at the distal root. The tooth was diagnosed with acute apical periodontitis. The margin was located within the gingival sulcus.	Crown lengthening	37	9.1
	Deep margin elevation (DME)	228	56.0
	Extraction	30	7.4
	Final restoration without any additional	53	13.0
	Gingivectomy	59	14.5

A 33-year-old female otherwise healthy, presented to the dental clinic with a chief complaint of right maxillary molar area. The radiographic examination had shown secondary mesial caries in tooth 17 under old amalgam restoration, and caries in the mesial of tooth #16 can be seen. As a result of diagnostic tests, irreversible pulpitis was diagnosed for tooth #17. The margins of the healthy tissue of the cavity were found to be completely subgingival.	Crown lengthening	129	31.7
	Deep margin elevation (DME)	157	38.6
	Extraction	16	3.9
	Final restoration without any additional	31	7.6
	Gingivectomy	74	18.2
A 55-year-old female otherwise healthy, presented to the dental clinic with a chief complaint of acute pain in the right mandibular molar area. Periapical radiograph had shown, the presence of a class II extensive restoration of tooth #46 distally filtered and secondary caries reaching the bone crest and the pulp chamber can be seen. Irreversible pulpitis was diagnosed. The distal margin of the cavity is completely at the bone level.	Crown lengthening	136	33.4
	Deep margin elevation (DME)	98	24.1
	Extraction	131	32.2
	Final restoration without any additional	19	4.7
	Gingivectomy	23	5.7

According to **Figure 2**, 63.6% of participants had good KAP scores, 27.3% had moderate KAP, and 9.1% had low KAP towards deep margin elevation.

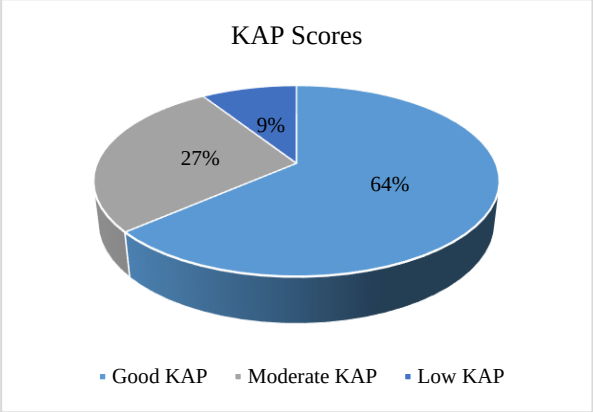

Figure 2. Knowledge, attitude, and practice scores of participants towards deep margin elevation (n= 407)

Table 4 shows participants' sociodemographic characteristics in association with their KAP scores. KAP was only associated with participants' nationality (P= 0.020), but not with gender, work, or experience of participants (P> 0.05).

Table 4. Participants' sociodemographic characteristics in association with their KAP scores (n= 407).

		KAP Score			Total (N=162)	*P value
		Good KAP	Moderate KAP	Low KAP		
Gender	Male	136	53	16	205	0.465
		33.4%	13.0%	3.9%	50.4%	
	Female	123	58	21	202	
		30.2%	14.3%	5.2%	49.6%	
Nationality	Saudi	255	104	37	396	0.020
		62.7%	25.6%	9.1%	97.3%	
	Non-Saudi	4	7	0	11	
		1.0%	1.7%	0.0%	2.7%	
Region	0rthern	42	10	6	58	0.471
		10.3%	2.5%	1.5%	14.3%	
	Central	31	15	5	51	
		7.6%	3.7%	1.2%	12.5%	

	Eastern	26	16	4	46	
		6.4%	3.9%	1.0%	11.3%	
	Southern	77	37	15	129	
		18.9%	9.1%	3.7%	31.7%	
	Western	83	33	7	123	
		20.4%	8.1%	1.7%	30.2%	
Current Position	Dental intern	155	73	24	252	0.521
		38.1%	17.9%	5.9%	61.9%	
	General Dentist	104	38	13	155	
		25.6%	9.3%	3.2%	38.1%	
Workplace	Government	108	46	14	168	0.814
		26.5%	11.3%	3.4%	41.3%	
	Private	63	22	8	93	
		15.5%	5.4%	2.0%	22.9%	
	unemployed	88	43	15	146	
		21.6%	10.6%	3.7%	35.9%	
Years of experience	Fresh graduate	167	68	20	255	0.322
		41.0%	16.7%	4.9%	62.7%	
	1 year	27	12	3	42	
		6.6%	2.9%	0.7%	10.3%	
	2 years	23	9	6	38	
		5.7%	2.2%	1.5%	9.3%	
	3 years	21	12	2	35	
		5.2%	2.9%	0.5%	8.6%	
	4 years	11	2	1	14	
		2.7%	0.5%	0.2%	3.4%	
	5 years and More	10	8	5	23	
		2.5%	2.0%	1.2%	5.7%	

*Chi-square test (P≤0.05) significance

The preservation of healthy tooth structures is one of the fundamental objectives of modern restorative dentistry. So, it is suggested to use less invasive preparation techniques and recommendations. The foundation of DME is the coronal relocation of the restorative margin rather than the displacement of the periodontium's margin by cavity constraints [16, 17]. Modern clinical dentistry is conservative and can sometimes substitute the less invasive DME for more invasive crown-lengthening procedures. Anatomic issues from the surgical approach, such as being close to root concavities, the area of the furcation, and attachment loss, are possible. Sub-gingival preparations create challenges that may make it more difficult to complete subsequent steps, such as rubber dam isolation and traditional and digital imprint capturing [4, 18].

According to the study's findings, 63.6% of participants had good KAP scores, 27.3% had moderate KAP, and 9.1% had low KAP towards deep margin elevation. 83.3% of the dental professionals who took part had heard of DME, but only 39.8% of dentists in the public and private sectors had used it in dental offices. This finding emphasizes the fact that, despite DME's extensive history in the literature, it is still a relatively new method for most dentists to use in dental offices. This was higher than reported in a previous Saudi study conducted in the Riyadh region reported that almost half participants heard of DME before but only around 30% had used the technique before [2]. Another Saudi study reported that 58% of the cohort knew about the concept of DME [19]. Indirect restorations performed on teeth with DME need to be followed up on, even though good survival rates have been observed, according to a 2019 study. This is because dental restorations take a while to disintegrate [20]. Additionally, only a few numbers of studies [21] have recorded the success rate of applying this strategy therapeutically.

More than half of the participants in this survey felt that clinical attachment loss could result from surgically dislocating the periodontium to expose the gingival borders. This is in keeping with earlier literature from Saudi Arabia and elsewhere [2, 22, 23].

There is still discussion today about which material would be best to use: fluid composites, highly filled hybrids, or glass ionomer cement. Glass ionomers treated with resin are not advised because of their poor mechanical qualities and high solubility rates [3]. In this study, 35.4% of participants chose RMGEC as the best material used with the closed sandwich technique.

According to our study results, 78.9% agree that space between the margin and the alveolar crest (biological width) is a factor that should be known before deciding to use DME (63.3% agreed on 2mm as appropriate). This was higher than reported by a previous Saudi study found that 67.7% of the respondents agreed with the biological width and most of the participants also considered 2 mm as the minimum standard biological width to be applicable for any restorative procedure [2]. According to evidence, the average biological width is 2.04 mm, which is made up of the connective tissues' mean width of 1.07 mm and the epithelium's mean width of 0.97 mm. To prevent inflaming the periodontium, which could result in gingivitis or periodontitis, the biological width is a feature that should be taken into consideration while performing any surgery [24].

Most responders chose the most conservative treatment option for addressing proximal boxes in posterior teeth that are positioned below the gingival level in the study's offered clinical situations. Similar results were found in India [4] and Saudi Arabia [2], showing that dentists have adopted a conservative approach by using minimally invasive dentistry (MID) to control caries. Therefore, it is advised that all dental professionals practice DME whenever it is practical to be conservative. In addition to raising the gingival border of subgingival preparations, DME also offers instantaneous dentin sealing (IDS), which results in a thickened, reinforced collagen fibril interphase. This method also has higher bond strengths, decreased sensitivity, decreased marginal leakage, and improved retention [25].

Knowledge, attitude, and practice score were only significantly associated with participants' nationality, but not with their work position or years of experience. This was contrary to a previous Saudi study reported that correlations between knowledge of DME and gender, work environment, and years of experience. However, only the work context and 0 years of experience were linked to awareness of DME in multivariable analysis [19].

Conclusion

In conclusion, participants show moderate knowledge, attitude, and practice scores toward DME. As an alternative to surgical crown lengthening, it is advised that dental professionals implement this approach in their dental clinics. Although the number of years of experience and dentist rank may have an impact on the clinical decision, a more thorough factorial study, and larger sample size are required. As there is limited clinical data available, more research must be done to deter the use of this approach in clinical practice.

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Conflict of interest: None

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Ethics statement: Ethical approval was obtained from the Research Ethical Committee at the faculty of dentistry at King Abdulaziz University, Saudi Arabia (Ethical approval number: 139-12-22) Participants were informed that their participation was voluntary, and filling out the questionnaire indicates their consent to participate.

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