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Evaluation of Attitudes, Awareness and Practice toward Endocrown in Post-Endodontic Teeth Management among Dental Practitioners in Benghazi, Libya: Cross-Sectional Study

Khadiga I. Elfallah [a], ***Rania S. Eltawati*** [b]*

[a] *Lecturer, Department of Fixed Prosthodontics, Faculty of Dentistry, University of Benghazi, Benghazi, Libya*
[b] *Lecturer, Department of fixed Prosthodontics, Faculty of Dentistry, University of Benghazi, Benghazi, Libya*

A B S T R A C T

Endocrown considered as one of post endodontic restorations that should preserve and protect the remaining tooth structure while giving satisfactory aesthetics appearance, its form, and good function. The endocrown is a monoblock porcelain restoration with a circular butt-joint finish line and a central retention cavity inside the pulp chamber. Endocrown has been used as an alternative choice to the post and core and conventional fixed partial prostheses in the endodontic treated teeth. The aim of this study was to assess the level of Knowledge, attitude and Practice toward endocrown as one of post endodontic management in practice amongst dental practitioners (DPs). Materials and Methods: A descriptive cross - sectional study was done among dental interns, general practitioners, fixed prosthodontists and other dental specialists from various institutions in Benghazi, Libya in 2023. Total of 150 participants. The study was conducted as a descriptive survey through online questionnaire composed of 21 questions with multiple choice answers pattern. Data from the completed questionnaires were analyzed using the Statistical analysis that performed with the aid of the statistical package for the social sciences (SPSS) computer program (version 25 windows). Results: The most of dental practitioners (96%) reported that they were aware of the use of endocrown as one of the post endodontic management. However, more than third of dental practitioners (DPs) (39.3%) said that they had practiced the use of endocrown during their training. Conclusion: Within the limitation of the study, dental practitioners (DPs) of Benghazi showed less training and experience in using the endocrown for post-endodontic restoration. In regard to their knowledge, they displayed an appropriate level of knowledge and awareness of the use of endocrown as a post-endodontic management tool.

Keywords: Attitude, Dental Practitioner, Endocrown, Post endodontic management, Awareness And Practice.

1. Introduction

Coronal rehabilitation of endodontically treated posterior teeth is still a controversial issue. Although the classical crown supported by radicular posts remains widely spread in dentistry, its invasiveness has been largely criticized. With the advance of adhesive dentistry and new resources of restoring endodontic treated teeth, endocrown is a restorative option for endodontically treated teeth which have been successfully used because it is a sound, conservative, efficient technique that preserves sound tooth structure, avoids further stresses and destruction of the radicular dentine and thus reduces the chance of root fracture and iatrogenic damage during preparation. It eliminates the chance of perforation of the root during post preparation. Endocrown could be used with engage the large pulpal chamber of root of endodontically treated molars with ceramic etched restorations which provide cuspal coverage.

Studies found that endocrown could be made following the development of reinforced ceramics which can be acid-etched, that have aggregate strength and esthetic, that bond to the dental structure, and which have developed from broader knowledge of the biomechanical behaviour of depulped teeth restored with and without intra-radicular posts**.**

Pissis was the forerunner of the endocrown technique and has described it as the 'mono-block porcelain technique inn 1995. [(1)] Then in 1999, Bindle and Mörmann describe it as adhesive endodontic crowns and characterized as total porcelain crowns fixed to endodontically treated posterior teeth. [(2)] The first clinical endocrown report was published in 2008 by Lander and Dietschi. [(3)]

In 2009, ceramics were considered the material of choice for these restorations over composite resins. [(4)] Endocrown indicated in successfully root treated molars, Excessive Loss of coronal dental tissue, limited inter occlusal space (short crowns). And short, calcified, or curved root canals that make post application is impossible. [(5)]

2. Materials and Methods

The study was conducted as a descriptive survey of various dental practitioners in Benghazi. A self-administered questionnaire consists of 20 questions with multiple-choice answers pattern was prepared to obtain information about knowledge, attitude and practice towards endocrown restorations. (Table2) A total of 150 dentists were employed as participants. The questionnaires were distributed online to them. After collecting data, statistical analysis was done.

3. Statistical Analysis

Statistical analysis was performed with the aid of the statistical package for the social sciences (SPSS) computer program (version 25 windows). X2 was used when needed. *P* value considered significant when $P \leq 0.05$.

4. Result

Self-administered questionnaire assessing the knowledge of endocrown restoration. A total 150 participant, 122 (81.3%) were female, and 28 (18.7%) were male. About 88 (58.7%) were practicing dental work for about 1-5 years, 15 (10%) 5-10 years, 22 (14.7%) 10-15 years, and 25 (16.7%) were practicing for more than 15 years.

Dental intern participants count for 26 (17.3%), General practitioners were 81(54%), fixed prosthodontists 19 (12.7%), and other dental specialties were 24(16%).

About 45(30%) of our participants were employed at dental schools, 55 (36.7%) were at private clinics, 8 (5.3%) were at hospitals, 48 (28%) were employed in more than one place.

Table 1: Demographic structure of the study population

	N	%
Male	28	18.7
Female	122	81.3
1-5 years	88	58.7
5-10 years	15	10.0
10-15 years	22	14.7
More than 15 years	25	16.7
Newly graduated dentists (interns)	26	17.3
General practitioner	81	54.0
Fixed prosthodontist	19	12.7
Other speciality	24	16.0
Dental schools	45	30.0
Private clinics	55	36.7
Hospitals	8	5.3
More than one place	42	28.0

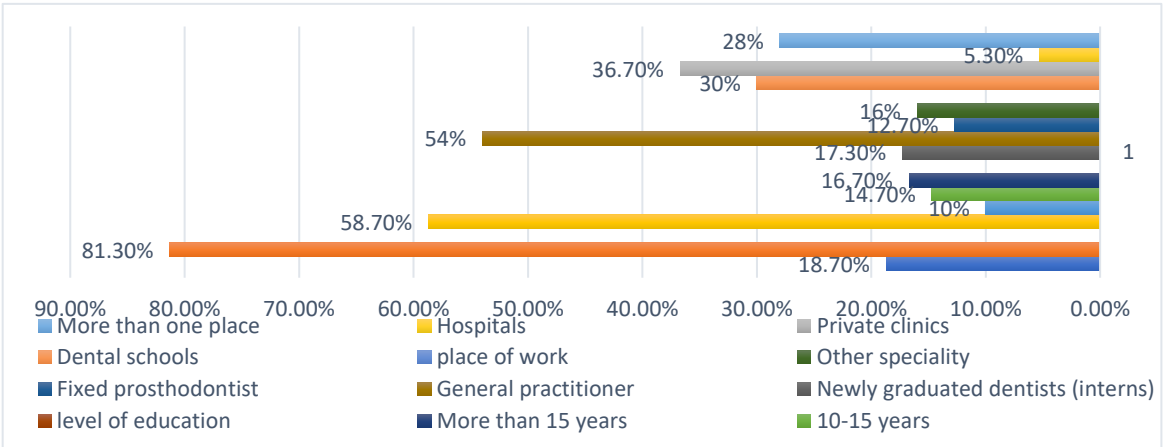

Figure.1 Demographic characteristics of the study population

The respondence about the question: Have you heard about Endo crown (EC)? 100% of the intern students respond positively, 95.1% of the general practitioner respond positively, 18(94.7%) of the fixed prosthodontists respond positively, and (95.8%) of the dentists of the other specialties respond positively a total 96% of the all participants reported positive.

The knowledge regarding indications of the endocrown restoration

All of the fixed prosthodontists (100%) respond to molar teeth as the teeth of indication for endocrown restoration, while the (96.2%), (91%), and (87.5) of interns, general practitioner, and other specialty respectively responds for the canines and premolars as the teeth indicated for endocrown restoration.

About 11 (42.3%), of the interns 31(38.3%)of the general practitioners, 9 (47.4%)of the fixed prosthodontists, and 4 (16.7%) of the other dental specialty respond to loss of one wall as clinical indication of endocrown restoration.

While 6 (23.1%) interns, 15 (18.5%) general practitioners, 4 (21.1%) fixed prosthodontists, and 3 (12.5%) of other specialties respond to Loss of two walls as clinical indication of endocrown restoration.

And 9 (34.6%) interns, 35(43.2%) general practitioner, 6(%31.6) fixed prosthodontists, and 17(70.8%) of the other dental specialty respond to Loss of three walls as clinical indication of endocrown restoration.

The knowledge regarding endocrown preparation

About the minimum occlusal height required for EC preparation 17(65.4%) interns, 57(70.4%) of the general practitioner, 17(89.5%) of the fixed prosthodontists, and 15(62.5%) of the other dental specialty respond to2mm. while 6(23.1%) interns, 16(19.8%) of the general practitioner, 1(5.3%) of the fixed prosthodontists, and 5(20.8%) of the other dental specialty respond to 3mm. And 3 (11.5%) interns, 8(9.9%) general practitioners, 1(5.3%) of the fixed prosthodontists, and 4 (16.7%) of the other dental specialty respond to 4mm.

The ideal pulp chamber height to the occlusal of EC 29 (35.8%) of the general practitioner, 7(26.9%) interns, 5(20.8%) of the other dental specialty, 4(21.1%) of the fixed prosthodontists respond to Less than 3 mm. While 40(49.4%) of the general practitioner, 10(52.6%) interns, 10(52.6%) of the fixed prosthodontists, 11(45.8%)%) of the other dental specialty respond to About 4 mm. And 7(26.9%) interns, 5(26.3%) of the fixed prosthodontists, 8(33.3%) of the other dental specialty, and 12(14.8%) of the general practitioner respond to Form 4-7 mm.

Concerning ferrule preparation with EC 57(70.4%) of the general practitioner, 17(89.5%) of the fixed prosthodontists, 17(65.4%) interns, 15(62.5%) of the other dental specialty respond positive. On other hand 8(42.1%) of the fixed prosthodontists, 9(37.5%) of the other dental specialty, 7(26.9%) interns, and 23(28.4%) of the general practitioner respond negative. While 9(37.5%) of the other dental specialty, 23(28.4%) of the general practitioner, 7(26.9%) interns, and 4(21.1%) of the fixed prosthodontists had no idea.

Finish line Type 14(53.8%) interns, 18(22.2%) of the general practitioner, 1(5.3%) of the fixed prosthodontists, and none of the other specialties respond to Chamfer finish line. While10 (41.7%) of the other specialties, 25(30.9%) of the general practitioner, 7(26.9%) interns, 1(5.3%) of the fixed prosthodontists respond to Shoulder finish line. And 14(58.3%)of the other specialties, 38(46.9%)of the general practitioner, 5(19.2%) interns, 17(89.5%) of the fixed prosthodontists respond to Circular butt joint finish line.

Table .2 Response rates of the participants on different parameters evaluated.

	Interns	G p	Fixed prosthodontist	Other	Total	*P* value
Q1_Have you heard about Endocrown (EC)?						0.717
Yes	26(100%)	77(95.1%)	18(94.7%)	23(95.8%)	144 (96%)	
no	0	4(66.7%)	1(16.7%)	1(16.7%)	6 (4%)	
Q2_Which teeth do you think that indicated for EC?						
Anterior	0	2(2.5%)	0	2(8.3%)	4(2.7%)	0.462
Canine and premolars	1(3.8%)	5(6.2%)	0	1(4.2%)	7(4.7%)	
Molars	25(96.2%)	74(91.4%)	19(100.0%)	21(87.5%)	139(92.7%)	
Q3_Clinical indication for EC when,						
Loss of one wall						
Loss of two walls	11(42.3%)	31(38.3%)	9(47.4%)	4(16.7%)	55(36.7%)	0.155
Loss of three walls	6(23.1%)	15(18.5%)	4(21.1%)	3(12.5%)	28(18.7%)	
	9(34.6%)	35(43.2%)	6(31.6%)	17(70.8%)	67(44.7%)	
Q4_What do you think about the minimum occlusal height required for EC preparation is						0.558
2mm	17(65.4%)	57(70.4%)	17(89.5%)	15(62.5%)	106(70.7%)	
3mm	6(23.1%)	16(19.8%)	1(5.3%)	5(20.8%)	28(18.7%)	
4mm	3(11.5%)	8(9.9%)	1(5.3%)	4(16.7%)	16(10.7%)	

Q5_The ideal pulp chamber height to the occlusal of EC?						
Less than 3 mm	7(26.9%)	29(35.8%)	4(21.1%)	5(20.8%)	45(30.0%)	0.407
About 4 mm	12(46.2%)	40(49.4%)	10(52.6%)	11(45.8%)	73(48.7%)	
Form 4-7 mm	7(26.9%)	12(14.8%)	5(26.3%)	8(33.3%)	32(21.3%)	
Q6_Do you think is important to used ferrule preparation with EC?						
yes						0.535
no	13(50.0%)	35(43.2%)	7(36.8%)	6(25.0%)	61(40.7%)	
no idea	6(23.1%)	23(28.4%)	8(42.1%)	9(37.5%)	46(30.7%)	
	7(26.9%)	23(28.4%)	4(21.1%)	9(37.5%)	43(28.7%)	
Q7_Type of finish line with EC?						
Chamfer						*P*<0.001
Shoulder	14(53.8%)	18(22.2%)	1(5.3%)	0	33(22.0%)	
Circular butt joint	7(26.9%)	25(30.9%)	1(5.3%)	10(41.7%)	43(28.7%)	
	5(19.2%)	38(46.9%)	17(89.5%)	14(58.3%)	74(49.3%)	
Q8_Main mechanism of retention for EC						
Adhesive	3(11.5%)	15(18.5%)	3(15.8%)	1(4.2%)	22(14.7%)	0.361
Pulp chamber	1(3.8%)	11(13.6%)	2(10.5%)	5(20.8%)	19(12.7%)	
Both	22(84.6%)	55(67.9%)	14(73.7%)	18(75.0%)	109(72.7%)	
Q9_Do you think that EC requires surface treatment before cementation ?						0.727
yes	23(88.5%)	69(85.2%)	18(94.7%)	21(87.5%)	131(87.3%)	
no	3(11.5%)	12(14.8%)	1(5.3%)	3(12.5%)	19(12.7%)	
Q10_Cement used for EC cementation?						
Resin composite	24(92.3%)	58(71.6%)	18(94.7%)	16(66.7%)	116(77.3%)	0.092
Glass ionomer	2(7.7%)	21(25.9%)	1(5.3%)	8(33.3%)	32(21.3%)	
Zinc oxide eugenol	0	2(2.5%)	0	0	2(1.3%)	
Q11_What do you think the type of ceramic used for fabrication of EC?						
Glassy ceramic						P<0.001
Zirconia	8(30.8%)	16(19.8%)	15(78.9%)	5(20.8%)	44(29.3%)	
Both	12(46.2%)	24(29.6%)	2(10.5%)	11(45.8%)	49(32.7%)	
	6(23.1%)	41(50.6%)	2(10.5%)	8(33.3%)	57(38.0%)	
Q12_Method of EC fabrication?						
CAD/CAM	18(69.2%)	45(55.6%)	11(57.9%)	14(58.3%)	88(58.7%)	0.076
Hot pressing	2(7.7%)	18(22.2%)	8(42.1%)	4(16.7%)	32(21.3%)	
No idea	6(23.1%)	18(22.2%)	0	6(25.0%)	30(20.0%)	
Most common Advantage of EC over conventional post and core crown:						
Less time						0.617
Less expensive	3(11.5%)	12(14.8%)	0	2(8.3%)	17(11.3%)	
Easy to perform	1(3.8%)	6(7.4%)	0	2(8.3%)	9(6.0%)	
Conservative	4(15.4%)	8(9.9%)	4(21.1%)	4(16.7%)	20(13.3%)	
	18(69.2%)	55(67.9%)	15(78.9%)	16(66.7%)	104(69.3%)	
Main Disadvantage of EC						
Deboned	16(61.5%)	54(66.7%)	17(89.5%)	12(50.0%)	99(66.0%)	0.178
Root fracture	4(15.4%)	9(11.1%)	1(5.3%)	6(25.0%)	20(13.3%)	
Secondary caries	6(23.1%)	18(22.2%)	1(5.3%)	6(25.0%)	31(20.7%)	
Have you practice doing EC previously during your training ?						0.001
yes	6(23.1%)	29(35.8%)	15(78.9%)	9(37.5%)	59(39.3%)	
no	20(76.9%)	52(64.2%)	4(21.1%)	15(62.5%)	91(60.7%)	

How many cases of EC have you done so far?						
0-5	25(96.2%)	75(92.6%)	8(42.1%)	18(75.0%)	126(84.0%)	P<0.001
5-10	0	3(3.7%)	4(21.1%)	6(25.0%)	13(8.7%)	
10-15	0	1(1.2%)	1(5.3%)	0	2(1.3%)	
15-20	0	2(2.5%)	1(5.3%)	0	3(2.0%)	
More than 2	1(3.8%)	0	5(26.3%)	0	6(4.0%)	

The knowledge regarding endocrown retention and cementation

Both adhesive and Pulp chamber together as the main mechanism of retention for EC responded by 22(84.6%)interns, 18(75.0%) of the other dental specialty, 14(73.7%) of the fixed prosthodontists, and 55(67.9%)of the general practitioner.

The need of surface treatment responded by 18(94.7%) of the fixed prosthodontists, 23(88.5%) interns, 21(87.5%) of the other dental specialty, 69(85.2%) of the general practitioners.

Resin composite as Cement used for EC cementation respond by 24 (92.3%) intern, 58(71.6%) of the general practitioner, 18(94.7%)of the fixed prosthodontists, and 16(66.7%)of the other dental specialty. While 21(25.9%) of the general practitioner, 8(33.3%) of the other dental specialty, 2(7.7%) intern, and 1(5.3%) of the fixed prosthodontists respond to Glass ionomer as Cement used for EC, only 2(2.5%) of the general practitioner respond for Zinc oxide eugenol as Cement used for EC cementation.

The knowledge regarding fabrication of EC

The type of ceramic used for fabrication of EC 8(30.8%) intern, 15(78.9%) of the fixed prosthodontists, 5(20.8%) of the other dental specialty, 16(19.8%) of the general practitioner respond to Glassy ceramic.

And 12(46.2%) interns, 11(45.8%) of the other dental specialty, 24(29.6%) of the general practitioner, 2(10.5%) of the fixed prosthodontists respond to Zirconia.

While 41(50.6%) of the general practitioner, 8(33.3%) of the other dental specialty, 6(23.1%) interns, 2(10.5%) of the fixed prosthodontists. They use both Glassy ceramic and Zirconia.

Method of EC fabrication more than the half of our participants of different educational level 88(58.7%) responded to CAD/CAM as the main tool to fabricate the endocrown restoration

The knowledge regarding of EC advantages and disadvantages.

More than the half of the participant 104(69.3%) respond to that the end crown is conservative as the most common Advantage of EC over conventional post and core crown, 16(61.5%),54 (66.7%),17(89.5%),12(50.0%),interns, general practitioner, fixed prosthodontics, and the other dental specialists respectively.

On the other hand a quite large number of the participants 99(66.0%) consider the main Disadvantage of EC was Deboned without a statistical significance in respond rate between the different levels of education

Regarding practicing endocrown 91(60.7%) of our participants have responded negatively to the question **Have you practice doing EC previously during your training?** there is a statistical significant in favour of fixed prosthodontics group with a positive respondence rate 15(78.9%)

The number of cases of EC have been done so far 126(84.0%) of our participants have done 0-5 cases again there is a statistical significance in favour of fixed prosthodontics group (Table.2)

5. Discussion

This cross-sectional study was used to assess the level of awareness and the current state of knowledge and opinions toward endocrown as one of post-endodontic management in practice amongst interns, dental practitioners, prosthodontists and other dental specialties. Based on the current study, the dental practitioners seem to have acceptable theoretical knowledge and are lacking in clinical practice.

In present study, when investigated about which teeth more indicated for endocrowns, All of the fixed prosthodontists (100%) respond to molar teeth as the teeth of indication for endocrown restoration, while the (96.2%), (91%), and (87.5) of interns, general practitioners, and other specialties respectively respond for the canines and premolars. On recent study on 2021 in India to assess the knowledge of dental practitioner about endocrown, majorities believed it is indicated for molars. However few had believed that is for anterior teeth and for canine when using endocrown as an option. [(6)]

Sevimli et al. suggested in their review that endocrown could be used as a prosthetic option in endodontically treated teeth in incisors, premolars and excessive tissue loss molars. [(7)] However, bindl et al. in their study detailed that the small pulp chamber in premolars will decrease the adhesive cement's bond strength.[(8)] In a clinical report by Lander et al., the different premolar crowns design where it has greater height than its width may increase the

chance of fracture and dislocation. [3] Therefore, the endocrown should be restricted to molars only, especially those with shorter crowns, root canal that is calcified, or narrow canals. [9]

There was a clinical trial conducted by Bindl et al. suggested endocrowns as a promising and efficient treatment for molars and premolars. [2] However, after few years, the same authors considered endocrowns as inadequate for premolars, They reported that this restorative approach was successful for 61 of the 70 restored molars (12% failure), while endocrowns on premolars underwent a higher failure incidence of 31% (5 out of 16 restorations.[8]

In the present study, when we asked about indication of endocrowns according to the remaining tooth structure, majority of fixed prosthodontics choose that one wall missing is the indication of endocrown about 47.4% of them and about 42.3% form interns have same opinion, while the majority of general Practitioners 43.2% of them and 70.8% from other specialties thought that 3 walls loss will be the better indication of endocrown. The fracture resistance of endocrowns was found to be higher in cases where there was a larger amount of remaining tooth structure. This could be due to the fact that the conservative preparation of teeth for endocrowns can help protect the remaining tooth structure. Prior studies have indicated that the quantity of remaining tooth structure plays a crucial role in determining the fracture resistance of endocrown restorations, preserving as much of the residual tooth structure as possible is still a crucial factor in the success of restorative treatment. The number of remaining walls is not directly proportional to the fracture resistance values. [10] A study suggested that when up to one half of the coronal tooth structure is missing, complete occlusal coverage is achieved conservatively using an endocrown. [11] An in-vitro study suggests that having no remaining walls significantly reduces the fracture resistance of endocrown restorations. [10] Endocrowns are indicated when there is excessive loss of coronal dental structure and limited inter-occlusal space, something that makes it impossible to obtain sufficient ceramic thickness over the metal or composite core. [12]

Regarding the occlusal preparation of the endocrown, the largest number of each respondents categories respond positively to 2 mm occlusal height, about 89.5%, 65.4 %, 70.4%, 62.5% for fixed prosthodontics, interns, general Practitioners, and other specialties respectively. While the least numbers of all participants were given to the 4 mm occlusal height. It is reported that the overall reduction in the height of the occlusal surface depends on the restorative material. More precisely recommended an overall reduction of 1 to 1.5 mm from the occlusal plane when resin composite is used, taking advantage of the material's elastic modulus and stress absorbing properties similar to those of dentine. [13] On the other hand, Fages et al. suggested at least 2 mm of reduction in the axial direction, when a mon4oblock ceramic material is used. [14]

At least 2 mm of occlusal reduction for an adequate restorative space that allows the uniform use of the material that will work in monoblock mode. [15] The greater the occlusal thickness of the restoration the higher the fracture resistance of the system, endocrowns are more prone to resist occlusal loading than conventional crowns. Indeed, the thickness of the occlusal portion of endocrowns varies from 3 to 7 mm, in contrast with conventional ones in which it varies from 1.5 to 2 mm. [16] Digiolise etal, compared endocrowns with 2 different materials and two dimensions of Preparation (2.5mm /5 mm) and concluded that Shallow endocrown preparations on premolars present less surface for adhesive luting and a difference in crown material becomes apparent in terms of load-to-failure. The use of amore flexible composite crown material appeared then a better option. [17]

Regarding Pulp chamber depth**,** Due to the development of adhesive cementation systems, the need for a retentive preparation for crowns has decreased. In 2018, Dartora et al. evaluated the biomechanical behavior of endodontically treated teeth restored using different extensions of endocrowns inside the pulp chamber; it has concluded that the greater extension of endocrowns provided better mechanical performance. A 5 mm extension presented lower intensity and a better stress distribution pattern than a 1 mm extension, which presented a low fracture resistance and a high possibility of rotating the piece when in function. [1]

The cavity depth must be at least 3 mm. The greater the extent of the pulp chamber better will be the mechanical properties of the restoration. The recommended endocrown measurements are a 3 mm diameter cylindrical pivot and a 5 mm depth for the first upper premolars and a 5 mm diameter and a 5 mm depth for molars. Bindl and Mörmann evaluated the performance of premolars and molars Endocrowns and confirmed that the premolars showed more failures than the molars, which were due to the adhesion failure on them. Premolars that have deep occlusal fissures have higher flexibility than ones that are shallow or fissure less. Premolar endocrowns must have a flatter occlusal table to minimize the crown height and the cuspal slopes resulting in shallower fissures to decrease cuspal bend and the chances of fracture during grinding. [18]

One report suggests that a 2-mm extension into the pulp chamber is sufficient. [19] While Ghajghouj and Tasar-Faruk. [20] evaluated the biomechanical behavior of endodontically treated teeth restored using different extensions of endocrowns inside the pulp chambers and concluded that the greater extension provided better mechanical performance. A 5-mm extension presented lower intensity and a better stress distribution pattern than a 1-mm extension, which presented a low fracture resistance and a high possibility of rotating the piece when in function. Extending in the apical direction to provide a greater adhesive surface to improve the monoblock cementation interface. [21]

Endocrowns with axial reduction and a shoulder finish line had higher mean fracture resistance values than endocrowns with butt margin design. [14] It has been also shown that butt joint designs provided a stable surface that resists the compressive stresses because it is prepared parallel to the occlusal plane. [22] The margins are supragingival, which facilitates impression making, and also there is minimal loss of sound tooth structure during preparation. [23]

Regarding the ferrule of the preparation, the presence of this element improves the resistance of the restoration against fracture, and a 1mm ferrule offers this advantage without presenting a greater risk of catastrophic fracture, as can be seen in those with a 2mm ferrule. [24] According to Einhorn et al.,[19] the addition of ferrule would endorse sufficient dentine removal of the endocrown preparation, so that the entire complex would be weakened. Furthermore, areas of reduced dentine wall thickness may result in over milling of the intaglio features of that area due to the limitations of the milling bur diameter. [24]

The assessment of dental practitioners' knowledge of which type of ceramic used for fabrication of EC, (38.0%) of dentist believes glassy ceramic and zirconia are using for fabrication (P<0.001). Glass ceramics were the material of choice for endocrown as they provide the advantage of surface modification, either with the use of hydrofluoric acid or air-abrasion, improving in that way their adhesion to the tooth tissues. [25] Lithium disilicate reinforced ceramics are widely used in clinic because of their excellent aesthetic performance and high fracture resistance. On other hand, ZouY et.al 2018 showed that monolithic zirconia Endocrown restorations present a reliable option to restore endodontically treated molars with extensively cuspal loss. [26] However, Skalskyi et.al 2018 reported that the zirconium dioxide Endocrown may cracked and leads to crack propagation in the tooth surfaces. [27]

Regarding the Surface treatment. In this survey most of dental practitioners (87.3%) gave answer the endoceown required surface treatment befor cementation and just (12.7%) never did it. Correct management of adhesive cementation protocols requires knowledge of adhesive principles in order to obtain durable bonding between tooth structure and restorative materials. Adherent surface treatments before cementation are essential to obtain high survival and success rates of Endocrown. [28] An appropriate surface treatment of Endocrown and dentine substrate is necessary to establish a strong and durable bond. [1] Surface treatment is based on the material that is chosen for Endocrown fabrication. Kalavacharia VK et al in 2015 reported that both HF acid and silanization significantly enhanced and improved the bond strength of lithium disilicate ceramics. [29] Otherwise many in-vitro studies reported that bond strength increased after APA with alumina oxide particles and cemented with resin cements to the zirconia ceramic. [30] Dentin surface treatment is done by using the application of phosphoric acid (35% to 37%) will enhance the dentin surface energy, removes the smear layer and promotes demineralization of surface hydroxyapatite crystals. The resin monomers or primer infiltrate the water-filled spaces between collagen fibers and produce a "hybrid layer". This "hybrid layer" promotes micromechanical retention for adhesive systems on dentin. [31]

Both mechanical and chemical retention are required in order to create a durable bond between resin-based luting agent and ceramic. According to current study, more than two third of the respondents (77.3%) were using Resin composite for cementation of endocrown while only (1.3%) of the respondents were using Zinc oxide eugenol. Sevimli et al. in their review suggested that the most popular type of luting cement for Endocrown is resin cement that consists of Bis-GMA or UDMA resin matrix and inorganic filler particles. Resin cements are routinely being used for cementation of ceramic, metal and composite indirect restorations. [7] Resin-based luting agents are preferred because of their greater retention and better interfacial filling in cementation of ceramic. [32] Otherwise, in recent research for Z.N. Emam et al. show that there was no significant difference in the interaction between ceramic materials and cementation techniques except for zirconia, which showed a significantly lower retention, mean value than the other ceramic materials for both cementation techniques. [33]

Regard to Method of fabrication, It can be milled using CAD-CAM or moulded under pressure. [34] In the current study more than half of the surveyed dentist participated of different educational level (58.7%) showed that CAD/CAM as the main tool to fabricate the endocrown restoration. Raafat Attia in his review proved that the results of clinical study agree that CAD-CAM endocrowns are an effective treatment solution for the restoration of extensively damaged endodontically treated molars. Excellent survival rates have been reported (94.87 %). In addition the endocrowns fabricated with the CAD/CAM technique of lithium disilicate and translucent zirconia demonstrates superior anatomic contour and stabilized interproximal contact along the full examination period. [35] In addition, more acceptable marginal fit, appropriate strength, minimizing chair time and esthetic of restoration can be achieved through CAD/CAM technologies. [36] However, CAD/CAM-fabricated fitting accuracy depends on the scanning process, milling procedure, post milling dimensional changes, and software design. Regarding the CAM process, the shape and the diameter of the milling instruments restricts the machining of the internal contour, which can affect the accuracy and the fitting of the restorations. [37]

The endocrown offers multiple advantages over the placement of a full crown. Minimally invasive preparations, with maximal tissue conservation, are now considered 'the gold standard' for restoring ETT. [7] The strength of endodontically treated teeth is reduced due to hard tissue loss, so further reduction of healthy tissue should be avoided when planning the restoration. [38] Compared to conventional crowns, endocrowns are easy to apply and require a short clinical time. Low cost, short preparation time, ease of application, minimal chair time and aesthetic properties are the advantages of endocrowns. [7] According to this study, the assessment of dental practitioners' the most common advantage of endocrown knowledge respond to that the endocrown is conservative (69.3%) as the most common Advantage of EC over conventional post and core crown.

When using ceramic as the material of choice the difference in the modulus of elasticity between the harder ceramic and dentin may increase the risk of debonding and root fracture in the endocrown. [28] Hence case selection is critical for ensuring clinical success with endocrowns. According to current study reported two third of the surveyed Benghazi dentist (66.0%) gave answer debonding as the main disadvantage, that agree with a previous study that reported a higher number of clinical failures due to debonding, especially in the first molar region with higher masticatory stress. [39] Y. Huang et al. (2023) show that the more concentrated the stress on the cement layer, leading to the risk of bonding failure increased. The stresses generated during mastication and polymerization shrinkage are considered to be the main causes of damage of adhesive restoration. [40]

6. Conclusion

Within the limits of the study, dental practitioners in Benghazi, Libya, commonly have less training and practice in management of post endodontic restoration using endocrown. In regard to their knowledge, they showed an acceptable level of knowledge and awareness of usage of endocrown as one of post endodontic management. More clinical training needed for the general practitioners to practice the endocrown as post-endodontic restoration.

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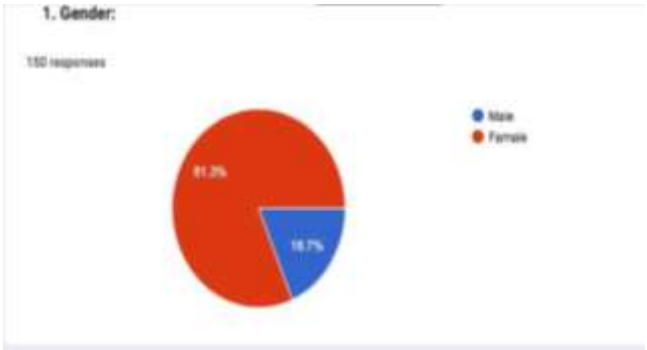
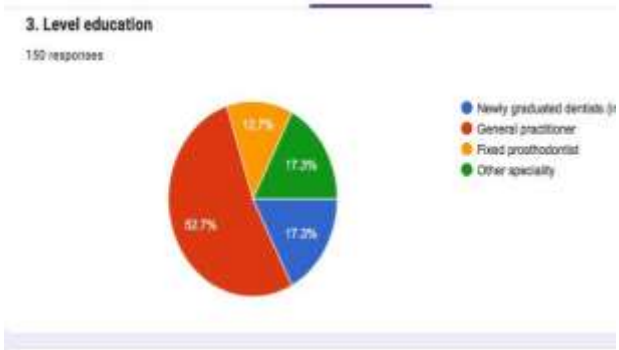
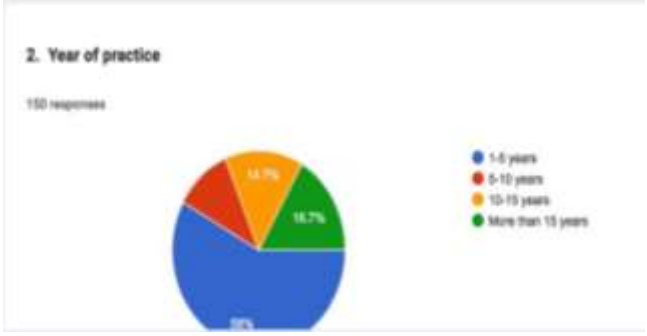
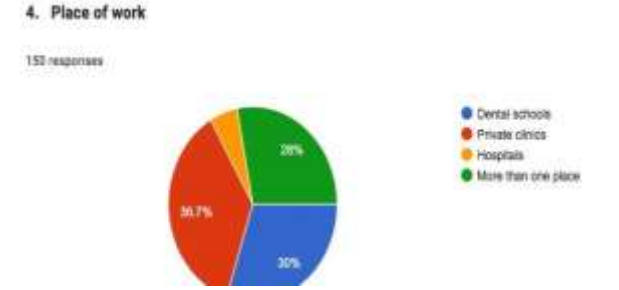
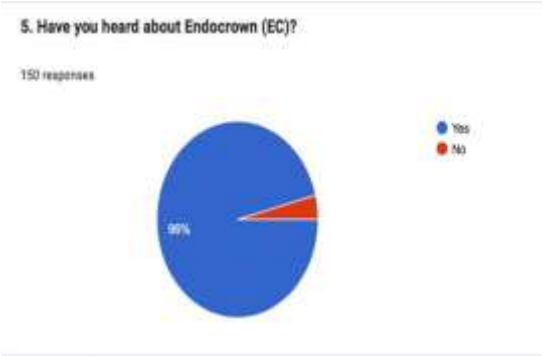
Appendix:

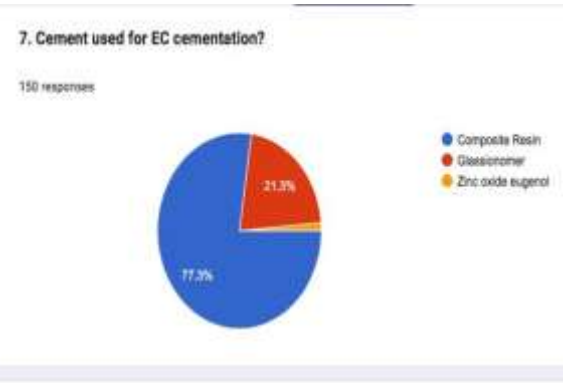

1. Gender:
150 responses
Male
Female
81.3%
18.7%

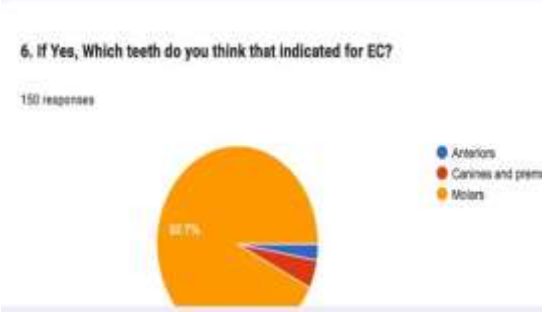

3. Level education
150 responses
Newly graduated dentists
General practitioner
Fixed prosthodontist
Other speciality
12.7%
17.3%
52.7%
17.3%

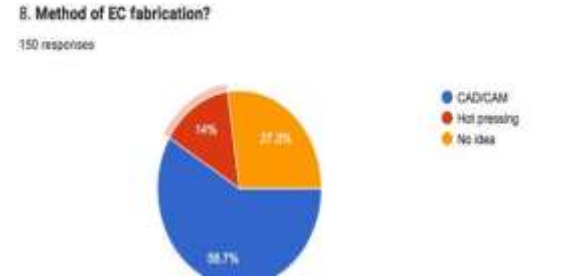

2. Year of practice
150 responses
1-5 years
5-10 years
10-15 years
More than 15 years
16.7%


4. Place of work
153 responses
Dental schools
Private clinics
Hospitals
More than one place
20%
30.7%
30%


5. Have you heard about Endocrown (EC)?
150 responses
Yes
No
99%


7. Cement used for EC cementation?
150 responses
Composite Resin
Glassionomer
Zinc oxide eugenol
21.3%
77.3%


6. If Yes, Which teeth do you think that indicated for EC?
150 responses
Anteriors
Canines and prem
Molars


8. Method of EC fabrication?
150 responses
CAD/CAM
Hot pressing
No idea
14%
27.3%
58.7%

9. Clinical indication for EC when,

150 responses

10.Type of finish line with EC?

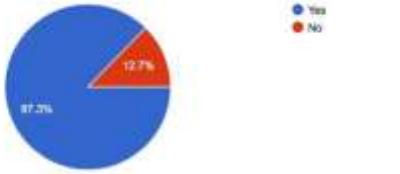
150 responses

13.Main Disadvantage of EC

150 responses

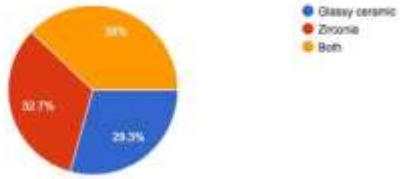
14.Do you think that EC requires surface treatment before cementation ?

150 responses



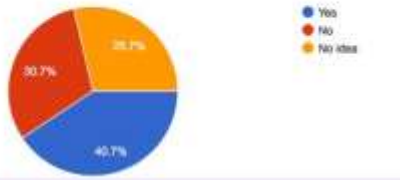
17. What do you think the type of ceramic used for fabrication of EC?

150 responses



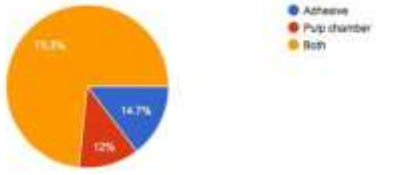
18. Do you think is important to used ferrule preparation with EC

150 responses



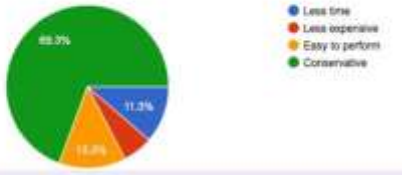
11.Main mechanism of retention for EC

150 responses



12.Most common Advantage of EC over conventional post and core crown:

150 responses



15. What do you think about the minimum occlusal height required for EC preparation is :

150 responses

16. The ideal pulp chamber height to the occlusal of EC?

150 responses

19. Have you practice doing EC previously during your training ?

150 responses

20. How many cases of EC have you done so far?

150 responses