



Knowledge and Practice on Fiber Post Placement during the Restoration of Endodontically Treated Teeth Among Dental Practitioners: A Survey-Based Study in Benghazi, Libya

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ABSTRACT:

Background: In the restoration of endodontically treated teeth (ETT), most professionals consider a prefabricated fiber post (FP) an alternative to metal posts due to its aesthetic features and an elastic modulus similar to that of dentine, improving stress distribution and reducing the risk of irreparable failures.

Aim: This study was conducted to assess the knowledge, Practice on fiber post placement during the restoration of endodontically treated teeth among dental practitioners in Benghazi.

Materials and Methods A descriptive cross-sectional study was conducted among dental practitioners in Benghazi, Libya. One hundred and twenty dentists were selected randomly. Data was collected using an electronic questionnaire. The questionnaire was designed to consist of three parts the first was demographic information. The other parts evaluated the knowledge of participants on Fps and their practical application. The collected data were statistically analyzed using (Version 25, SPSS) Descriptive analysis was conducted, which provided results in the form of frequencies and percentages.

Result. More than half (65.1%) of respondents believed that a fiber post reinforces an ETT and reduces the fracture probability. The majority (70.8%) of respondents heard about the monoblock concept. Regarding the rubber dam application (34.9%) of respondents reported that they are always using rubber dam isolation. 35.8% of respondents preferred to use phosphoric acid with bonding resin as surface treatment. Resin-based cement was the most favorable choice 77.4%. 43.4% of respondents preferred to use Dual cured flowable composite (core it).

Conclusion According to the results of our study there was good understanding and practice among dental practitioner in Benghazi Libya.

KEYWORDS: Endodontically Treated Tooth; Fiber Post; Knowledge; practice; dental practitioner.

I. INTRODUCTION

Endodontic adhesive restorations (fiber post with composite core) are the common treatment option for such teeth when there is a significant loss of coronal tooth structure to provide retention for the final coronal restoration(1). Aesthetic, easier clinical dependability and less expensive procedures are the main causes to select this type of post by dental practitioners (2).

Moreover, fiber post has unique properties, such as high tensile strength, fatigue resistance, and stiffness (modulus of elasticity), like that of dentin, leading to a favorable distribution of stresses on the luting material during flexion and torsional resulting in fewer root fractures(3, 4). Initially, their use was limited due to difficulties in achieving bonding to intracanal dentin, which was overcome by using dentin bonding adhesives along with a resin cement of similar flexibility, which provides improved adhesion within the root canal space(1).

Fiber post is aesthetically desirable especially for anterior teeth compared to a metal post which can cause discoloration of the soft tissue adjacent to the root surface(6). Although laboratory investigations indicated that fiber posts had favorable mechanical and physical qualities, clinical experience has revealed a broad variety of failure modes that have been documented in the literature. The most common one was an adhesive failure (7). There are several factors that might influence how firmly the post is attached to the root canal system, including, the type of cement used, technique of cementation, as well as the action of irrigant solutions at various concentrations on dentin



collagen, may all have an impact on the adhesion (8) (9).

This study was conducted to assess the knowledge and practice on the fiber post placement during the restoration of endodontically treated teeth among dental practitioners in Benghazi.

II. MATERIALS AND METHODS

a) Study design

A descriptive cross-sectional study was conducted among dental practitioners in Benghazi, Libya. One hundred and twenty dentists were selected randomly (from public and private dental clinics).

b) Questionnaire development

The self-designed questionnaire was prepared and included questions to assess knowledge and practice of using fiber post in management of endodontic treated teeth among dental practitioners in Benghazi. The aims and objectives of the study were explained within the survey. The questionnaire was designed to consist of three parts: the first was demographic information including gender, qualifications, age, and number of years of practicing experience. The second part

Table 1: Descriptive statistics of the participants

Demographic data		Numbers	(%)
Gender	Male	21	19.8
	Female	85	80.2
Age	31-39 years	52	49.1
	40-49years	16	15.1
	less than 30 years	34	32.1
	over 50 years	4	3.8
Qualifications	Specialist	44	41.5
	General dental practitioner	62	58.5
Years of experience	Less than 5 years	43	40.6
	6-10 years	29	27.4
	11-20 years	27	25.5
	More than 21 years	6	5.7

evaluated the basic knowledge about fiber post. The third part of the questionnaire was about practices for FP placement. The questions in this questionnaire were closed – ended questions.

c) Survey distribution

The questionnaire was online administered using the Google Form method. A link was sent via e-mail to the participants.

d) Data analysis

The collected data were statistically analyzed using IBM Statistical Package for Social Science for Windows (Version 25, SPSS) Descriptive analysis was conducted, which provided results in the form of frequencies and percentages.

III. RESULTS

One hundred and six respondents completed the questionnaire, 62(58.5%) of the respondents were general dental practitioners while 44 (41.5%) were specialists. The age of the study participants ranges from 31-60 years old. The participants included 21 (19.8%) males and 85(80.2%) females. The Majority of the respondents 43(40.6%) had experience of less than 5 years; whereas, 29(27.4%) had experience of 6-10 years, 27(25.5%) for 11-20 years and 6 (5.7%) for more than 21 years. Descriptive statistics of the participants are shown in Table 1.

As shown in Table 2 the descriptive responses of the participants to the survey items (1-4) related to basic knowledge on FP. More than half (65.1%) of respondents believed that a fiber post reinforces an ETT and reduces the fracture probability. While (24.5%) of them did not believe that. The majority (70.8%) of respondents heard about the monoblock concept. Less than half (37.7%) of respondents reported that placing of FP decreases microleakage and bacterial infiltration, while the same percentage (37.7%) of them believed that FP placement does not decrease microleakage and bacterial infiltration. Regarding the appropriate time for FP placement after endodontic treatment completed, 35.8% of respondents preferred to place FP within the first week, 32.1% of respondents placed FP within one month and 8.5% of them placed FP immediately after obturation.

Practices related to FP Placement:

As shown in Table 3 the descriptive responses of the participants to the survey items (5-7) related to the practices for FP placement. Regarding the rubber dam application, less than half (34.9%) of respondents reported that they are always using rubber dam isolation. While 10.4% of them had never used a rubber dam during the procedure of FP placement. Nearly half 48.1% of respondents preferred to follow the same criteria of metal post to determine the post width and length.. Regarding type of the irrigation solution that usually using during FP space preparation, half 50.9% of respondents were using normal saline, while Sodium hypochlorite was used by (15.1%) of the participants.



Data in Figure 1 showed the percentage of the respondents' responses related to the type of surface treatment used for the FP before cementation. Less than half 35.8% of respondents preferred to use phosphoric acid with bonding resin, while 8.5 % of them were using Alcohol cleaning and saline and 10.4% of them were using Silan only. Whereas 28.3% of respondents did not use any type of surface treatment.

Data in Figure 2 showed the percentage of the respondents' responses to the cement type they usually use for FP cementation. Resin-based cement was the most favorable choice among the respondents 77.4% whereas, (8.5%) of respondents

preferred using RMGIC. 20.8% of them preferred using Dual cure flowable composite.

Data in Figure 3 showed the percentage of the respondent's responses to the type of resin cement used for FP cementation. Two third 67.9% of respondents preferred to use Self-adhesive resin cement. However, less than half 27.4% of them were using two steps resin cement.

As shown in Table 4 the percentage of the respondents' responses to the preferred core material after fiber post placement. Less than half 43.4% of them preferred to use Dual cured flowable composite (core it), while CompCore was used by 41.5% of the participants.

Table 2: The descriptive responses of the participants related to basic knowledge on fiber post

Items related to basic knowledge on fiber post	Answers options	Number of respondents (%)
1. Do you believe that a fiber post reinforces an ETT and reduces the fracture probability?	yes	69(65.1%)
	No	26(24.5%)
	I don't know	11(10.4%)
2. Did you heard about the monoblock concept?	yes	75(70.8%)
	No	31(29.2%)
3. Do you think placing FP decrease the microleakage and bacterial infiltration?	Yes	40(37.7%)
	No	40(37.7%)
	I don't know	26(24.5%)
4. What do you think is the appropriate time to place the FP?	Immediately after endodontic treatment	9(8.5%)
	Within 1 st week	38(35.8%)
	Within 1 month	34(32.1%)
	Within 3-6 months	8(7.5%)

Table 3: The descriptive responses of the participants related to practices for FP placement

Items related to the practices for FP placement	Answers options	Number of respondents (%)
5. How often do you use rubber dam during restoration of ETT (Endodontically treated tooth)?	Always	37(34.9%)
	Sometimes	39(36.8%)
	Rarely	19(17.9%)
	Never	11(10.4%)
6. When you determine the post width and length do you follow the same criteria of metal post?	Yes	51(48.1%)
	No	39(36.8%)
	I don't know	16(15.1%)
7. Type of the irrigant you usually use during fiber post space preparation ?	Chlorhexidine	13(12.3%)
	Sodium Hypochlorite	16(15.1%)
	EDTA	4(3.8%)
	Normal saline	54(50.9%)
	No irrigant	19(17.9%)

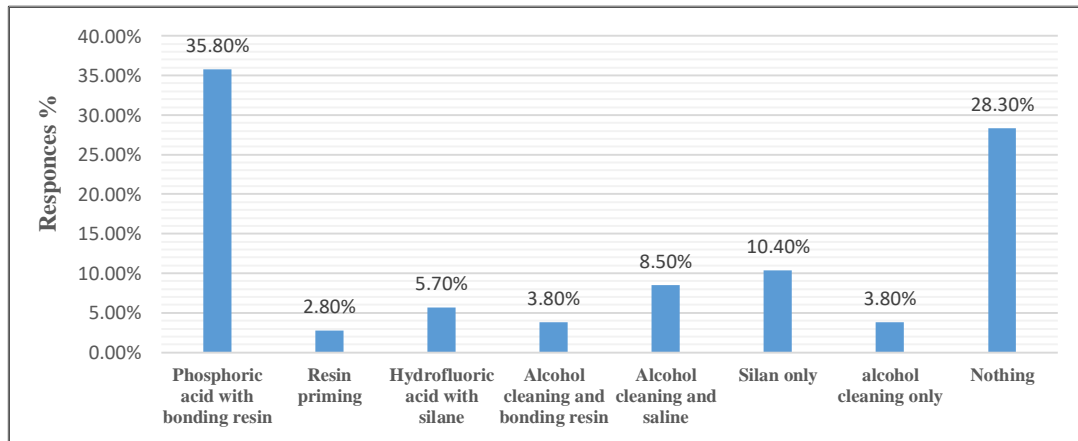


Figure 1 the percentage of the respondents' responses to the type of surface treatment used for the FP before cementation

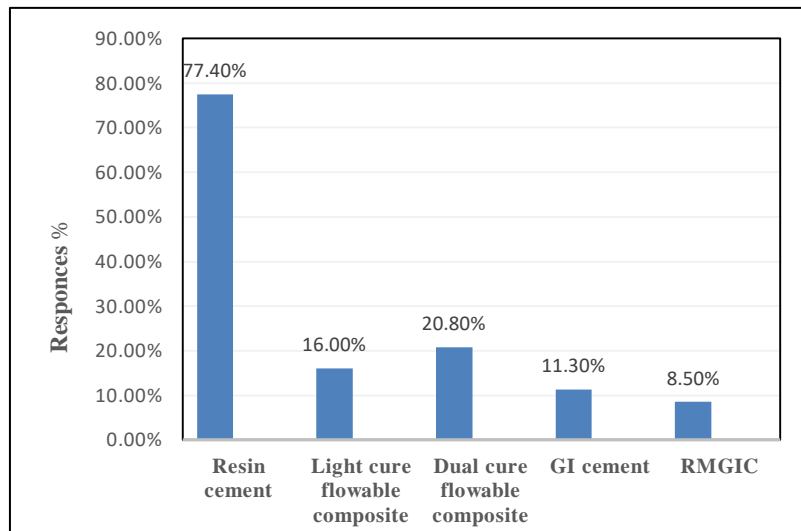


Figure 2 the percentage of the respondents' responses to the type of cement they are usually using for FP cementation

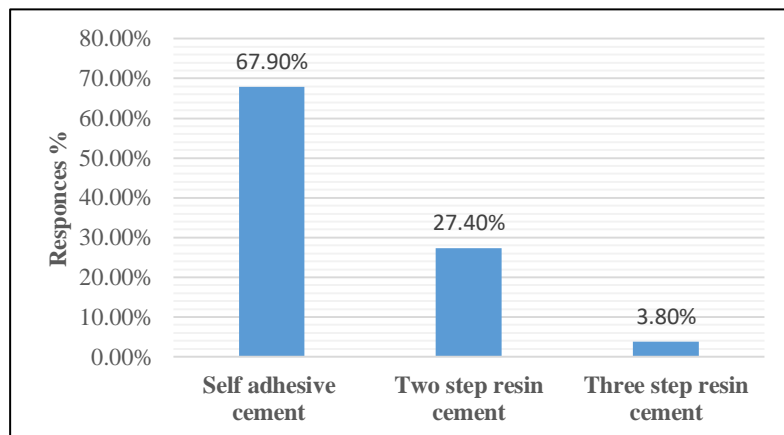


Figure 3 the percentage of the respondents' responses to the type of resin cement



Table4: The descriptive responses of the participants related to core material after post cementation

Item related to the core material	Answers options	Number of respondents (%)
Preferred core material after fiber post placement	Light-cured Packable Composite	40(37.7%)
	CompCore	44(41.5%)
	Light-cured flawable composite	17(16.0%)
	Dual cured flawable composite (core it)	46(43.4%)
	Glass ionomer filling	1(0.9%)
	Resin-Modified glass ionomer filling	1(0.9%)
	I do not know	6(5.7%)

IV. DISCUSSION

The dental practitioner's awareness of factors affecting the longevity of post-core systems such as post space preparation, effective irrigation solution, surface treatment for the post, and appropriate cement selection enhance the success of endodontic restorations(9,10,11).

Non-vital teeth are weak as a result of lower hardness values (12) and, in most cases, a significant amount of dental tissue was lost. Therefore the post primary function is to retain the core build-up which supports the final restoration and optimistically reinforces the tooth and increases resistance to masticatory load.

Some recent publications support the opinion of FP can reinforce the ETT (2, 3). The homogenous stress distribution by FP due to its composition and biomechanical properties plays a major role in promoting the fracture resistance of endodontic treated teeth. Unfortunately, this role is currently under debate. Recent studies have found similar survival rates for fiber posts compared to metal ones and report the same efficacy (4, 5). However, other studies showed that FP provided better loads distribution mainly at the interfaces (6, 7). Moraes et al. (2013) stated that fiber posts are superior to metal posts as fiber posts are less likely to cause root fracture due to their lower modulus elasticity similarly to dentine and show similar stress patterns under external impacts(8). Several studies have reported that the use of a post in endodontic treated premolars significantly improve their fracture resistance (9). In contrast other researchers found that the fiber post have no effect on the fracture resistance(10). In this current study, more than half (65.1%) of respondents believed that a fiber post reinforces an ETT and reduces the fracture probability on the other hand, only (24.5%) of them did not believed that.

The term "Monoblock" was introduced by Dr. Pierre Robin in 1902 which refers to a "Single unit" represents a compactly filled space with the core material and bonding substrate, which make up distinct material interfaces. These interfaces are used to categorize monoblocks into main, secondary, and tertiary monoblocks. The

monoblock must have a sufficient binding strength and an elastic modulus that is equivalent to dentin in order to meet the criteria. Fiber post and core material can fuse together and form these 'monoblocks' capacity in the root canal, making a complete seal possible to guarantee. The goal of achieving a monoblock is to distribute stresses evenly throughout the tooth and reduce the risk of fracture(21). In this current study, The majority (70.8%) of respondents heard about monoblock concept.

Placing a fiber post plays an important role to decreases coronal microleakage, If the patient has had endodontic treatment but has postponed getting permanent restorations, the seal of the temporary filling material has broken down, or filling materials and/or tooth structures have fractured or been lost, sealed root canals may become recontaminated. In vitro study was done by Torabinejad et al. (1990) showed that coronally unsealed ETT can be more reliable to microleakage and failure, and root canals without a post and crown are susceptible to recontamination when exposed to saliva for a brief period of time (11). In this study most clinicians believed the same acquired knowledge. Gomes et al. (2013) conduct an in vitro study to investigate the coronal microleakage of ETTwithout coronal restoration in two groups one with post space preparation and the other with the cemented post they found that recontamination of both groups in 24 hrs, 70% of the specimens of the canal carrying post cemented with resin cement infected after 29 days of exposure to fresh human saliva (12). This is in agreement with Magura et al. (1991) (13). From our survey the lack of distinct information was evident in this area in question of whether bacterial leakage occurs with the presence of the post, the answer was in equal proportions for those who answered 37.7% for each category. The percentage of those who answered not knowing was 24.5%. These results illustrate the negligence of some participants in the importance of rubber dam use during the procedure post-space preparation only 34.9% were concerned to use the rubber dam, and on the other hand, 36.8%, 17.9%



and 10.4% respectively sometimes, rarely and never use it. This is in contrast to results reported by Zahran et al. (2020) which showed that 67% of the participants were always inclined to the use of rubber dam isolation during post placement (14). However, Goldfein et al. have reported that rubber dam isolation was used only in 14% during post-placement. Likewise, Sarkis-Onofre have also reported that 93% of the participants are not inclined towards the use of rubber dam isolation during post placement (15).

Regarding the right time to place FP after completing the endodontic treatment. In the current study, 35.8% of respondents preferred to place FP within the first week, 32.1% of respondents placed FP within one month after endodontic treatment was completed and 8.5% of them placed FP immediately after obturation. This is in contrast to results reported by Zahran et al. (2020) which showed that 35% of the participants always or mostly tend to place the post immediately after obturation (14). In vitro study reported that time elapsed between canal obturation and post cementation significantly influenced FP retention, regardless of the type of resin cement. Fiber posts showed significantly higher retention if cemented after 24 hours of obturation than if cementation occurred after 2 weeks (16). However, the FP adhesion study showed that 5% sodium hypochlorite irrigation which is the common concentration used during endodontic treatment of root canals reduces the micromechanical interaction between adhesive resins and sodium hypochlorite treated dentin (17).

Length and width of the post were important factors in the success of the metal post, and this may not be the same with FP. In this study, nearly half 48.1% of respondents preferred to follow the same criteria of metal post to determine the post width and length. The retention and fracture resistance are affected by the length of the post used (18). This is in agreement with Buttel et al who found that the fracture strength of the 10 mm posts was greater than that of the 6 mm posts (19). On the other hand, Zicari et al. (2012) reported that short post can tolerate fatigue as same as the longer post. In addition, using short post preserves more tooth structure, reduces catastrophic failures and improves the possibility of repair regardless of the type of resin cement used(20). However, a recent in vitro study conducted by Neto et al. (2022) evaluated the effect of the length of FP on the fracture resistance of ETT, and they found that the fracture resistance has not been affected by the length of the post (21).

Intrinsic stability and retention of the post-and-core system are essential for a successful ultimate restoration (22). Adhesion of the intraradecular post influenced by several circumstances include; density and direction of the dentin tubules in the root canal walls, luting agent and its application in addition to the essential effect of irrigant solutions at various concentrations on dentin collagen (23). Different irrigant agents are used for cleaning and disinfection during post space preparation which may affect the bond strength of the luting cement used for post cementation. Mostly used irrigation among clinicians are sodium hypochlorite (NaOCl), ethylenediamine tetraacetic acid (EDTA), chlorhexidine gluconate (CHX) and saline. In this current survey, more than half of the participants 50.9% preferred to use saline which has no effect on the dentine surface. However, ERİK and Özyürek (2019) reported that the best dentinal penetration and bond strength values were achieved with EDTA solutions (24) which only count for 3.8% in this survey.

In the investigation by Bitter et al (2013), a significant reduction of the failure mode was observed for irrigation with 18% EDTA /5.25% NaOCl (25). In the current study, less number of dentists about 15.1% selected sodium hypochlorite as an irrigant during the procedure even though it's the most often suggested endodontic irrigation solution in the dental clinic due to its ability to dissolve and extensive antimicrobial properties. Unfortunately, it is ineffective in removing the smear layer, and according to reports, in order for the adhesive to reach the dentinal tubules and provide micromechanical retention, the smear layer must be removed before post cementation (17). NaOCl reduces the bond strength of resin cement (26) due to its inability to remove the smear layer unlike (EDTA). Irrigation with 3% H₂O₂ and 5% NaOCl or 17% EDTA for 60 seconds leads to drop in the microhardness of the dentin as reported by Saleh and Ettman (1999) (27). Only 12.3% of practitioners in our survey preferred to use Chlorhexidine as irrigation and according to Erdemir et al. (28, 29), bond strength to root dentin was greatly improved by irrigation with CHX solution.

From the literature, it appeared that the main FP failure was due to debonding which resulted of improper adhesion (30). Studies have been carried out to find the most effective method to treat the surface of the FP in attempt to enhance the FP retention; several techniques used for this purpose either mechanical using air abrasion or chemical by application of different materials on



the surface of the post before cementation. Silane is the main material used to enhance the post retention (31). In vitro study by Sahafi et al (2004) used mechanical and chemical methods for post pretreatment, and they concluded that the surface treatment does not affect the bonding of FP to resin cement(32). This is supported by other study by Albaladejo et al. (2007) (33). In contrast, a previous study in 2013 by Oliveira et al recorded the improvement of post retention by salinization (34). In the current study, only 10.40% of practitioners used silane as pretreatment while 28.30% of them used nothing. Interesting 35.80% of the participants used phosphoric acid as shown in Figure 1 they follow some of the manufacturer's recommendations even though studies show that phosphoric acid alone has the same cleaning effect as alcohol and does not have any effect on the composition of the fiber post (35). However, Magni et al. (2007) obtained the superior result from using phosphoric acid with chemical optimization than phosphoric acid alone (36). Alshahrani with his colleagues in 2021 examined the bond strength between FP and a composite resin core material. They concluded that the bonding after roughening of the fiber post with sandblasting or application of hydrofluoric acid is better than with silane or hydrogen peroxide (37).

The strength of FP is significantly influenced by luting agents, many types of cement are available for post cementation, Glass ionomer and Resin-modified glass ionomer cement (RMGIC) have chemical adhesion to the dentin substrate. According to in vitro study, the cementation of fiber posts with GIC and RMGIC shows promising results(38). This is supported by a further study by Lorenzetti et al. (2019) who compared the glass ionomer with self-adhesive resin cement and concluded that the cementation using glass ionomer cement has similar push-out bond strength to that of self-adhesive resin cement (39).

Three currently available adhesive approaches: etch-and-rinse, self-etch, and self-adhesive are used for fiber post cementation. In our study, resin cement was the most favorable choice among the respondents 77.4%. Whereas (8.5%) of respondents preferred to use RMGIC. Using self-adhesive resin in our study counts 67.90% which might be attributed to easy and faster application as mentioned by Peumans et al. (2005) (40).

In a previous study conducted by Domnez et al. (2005), it was determined that Total-etch adhesive systems and self-etching adhesives are more likely to have discrepancies

between infiltration depth and demineralization of the adhesive resin(41). The bond strength of total-etch systems is higher than that of one- and two-step self-etch systems, according to a study by Oskoe et al. (2009) (42). In a further study, they reported that the smear layer can be removed entirely with the help of phosphoric acid and etchants in etch and rinse systems, allowing for the decalcified intertubular dentin and dentinal tubule walls to hybridize(43). This was the same result of de Melo et al (2008) who carried in vitro study in an attempt to examine the bond strength of two total-etch adhesive systems (two- and three-step) and a self-etching system to coronal and root canal dentin they concluded that the best choice for adhesive endodontic restorations is the traditional total-etch three-step adhesive system (44). On the other hand, in a systematic review and meta-analysis of in vitro studies on the effect of resin cement on the retention of FP, they reported that retention of fiber post can be enhanced by using self-adhesive cement(45). However, in a study by Radovic et al. (2008), The results seem none of the three adhesive methods is better than the others(46).

The other main issue regarding cement selection is either self-curing or dual-cured composites are recommended for luting fiber posts(47). The use of light-cured materials for luting fiber post is not recommended, due to the incomplete and difficult curing (48). Self-curing is not an option because of the fast curing and short working time. The dual cured resin cement is desired to use, which has enough working time for polymerization (49). The majority of practitioners in our survey were using Dual cure self-adhesive resin cement.

Core build up around the fiber post is an important stage for the success of the final restoration (50). Different core materials are available to build up the crown foundation these material needs to have enough strength, high fracture resistance and should bond firmly with the fiber post as well as with the remaining tooth structure to enhance the crown retention and resistance to fracture. GI one of the material; that have been used to build up the foundation under the final restoration, unfortunately, does not meet the specifications as an optimal core material, this limit the use of RMGICs as a core build-up material to non-stress bearing locations.

Composite resin is still the supreme material for core buildup due to its high fracture resistance and micromechanical and chemical interaction may contribute to the retention of the core portion around the post (51). In our study the



majority of the candidates preferred using dual cured composite core material either flowable or packable the results were 43.4% and 41.5% respectively. Due to their low viscosity, flowable composites exhibited outstanding adaptability at the post surface (52), making them viable candidates for core build-up materials, but their bond strength performance was inferior to that of hybrid composites as core materials (53), Although in the study by Sadek et al. (2007) to investigate the strength of different core resin materials around the fiber post, they concluded that using the hybrid composite is better than flowable composite in spite of the good adaptability to the post surface of the later, its bond strength is comparatively weak (51). 37,7% of our candidates preferred conventional light curing composite even though the evidence indicates that higher filler composite enhances the strength of endodontically treated teeth in contrast to conventional composite resins (54).

V. CONCLUSION

From the results of this study, it appears that most of the dental practitioners in Benghazi acquire acceptable knowledge and demonstrated a good level of practice about the placement of the fiber post in the restoration of endodontically treated teeth.

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