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ORIGINAL RESEARCH ARTICLE

SURVEY OF STANDARD PROTOCOLS FOR ENDODONTIC TREATMENT IN CHITWAN, NEPAL

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ABSTRACT

Background: Endodontics is one of the fastest-growing disciplines which involves the introduction of many new instruments, materials, and techniques. This study aimed to assess the practice of the international standard protocol during the endodontic treatment among dentists in Chitwan, Nepal.

Methods: The present cross-sectional study was conducted on August 2020 among the dentist working in Chitwan, Nepal. 120 questionnaires were distributed to the dentist working in Chitwan, Nepal. The data were collected and descriptive analysis was done using SPSS ver. 22.

Results: From the total respondent, 104 were included in the survey. Fully filled form and those who perform endodontic treatment were included in the survey for further analysis. Cotton rolls with suction (93.3) and a radiograph with a file in the canal (85.6%) was the most common method for isolation and working length determination respectively. Most of the respondents (81.7%) used k-files with 84.6% following step-back technique for instrumentation of root canal. Autoclave is mostly (47.1%) used sterilization procedure autoclave. Sodium Hypochlorite and calcium hydroxide (CH) are the most common chemicals used for irrigation and intracanal medication respectively. Eugenol based sealer (76%) was the most common intracanal sealer used for obturation used commonly (82.7%) for cold lateral condensation technique. Cavit (89.4%) was the most popular temporary filling material. Difficulty cases are mostly referred (86.3%) for endodontic consultation.

Conclusions: Upgrading and reinforcement of knowledge about newer materials and techniques following protocols is required for endodontic treatment.

INTRODUCTION

Endodontics is one of the fastest-growing disciplines which involves the introduction of many new instruments, materials, and techniques. The primary goal of endodontic treatment is to eliminate completely or reduce the microbial population within the root canal system and to prevent re-infection by providing a tight seal in the root canal system.[1] Technical quality of root canal preparation for cleaning and shaping provide better hermetic seal against bacterial ingress achieving good endodontic treatment outcome.[2]

Studies have shown that the survival of teeth following endodontic treatment is higher when performed by specialists as compared to general dentists. [3,4] One study found success rate of endodontic treatment performed by GDP was 89.7% and by the specialist was 98.1% .[5] Several studies performed in Asian countries revealed that the majority of dentists do not comply with the formulated guidelines on the quality of root canal treatment.[6-14] Due to lack of knowledge and practice of newer instruments, materials, and techniques or fear of practice beyond the knowledge that was gained during undergraduate may compromise the standard treatment procedure and eventually affect the prognosis of the treatment.[8]

The majority of endodontic treatment in Chitwan. Nepal is provided by GDP due to a lack of endodontists. The purpose of this study was to collect information about knowledge, attitude, and practice of newer materials and techniques and the standard endodontic treatment protocol followed by dentists working in Chitwan, Nepal.

METHODS

The present cross-sectional study was conducted on August 2020 among the dentist working in Chitwan, Nepal. 120 structured questionnaires were distributed to the dentist working in Chitwan, Nepal. For this cross-sectional study, the questionnaire used by Vaitkus et al was taken.[7] A pilot study was carried out for reliability, validity and refinement by sending the questionnaire among 10 dentist who were not working in Chitwan and Cronbach's alpha was tested which was found to be 0.821. The sample size was calculated using the formula:

$z^2 \times pq/e^2/1+(z^2 \times pq/e^2N)$

N= total number of dentists working in Chitwan = 120,

Z= critical value of the normal distribution at 95% CI = 1.96

P= sample proportion= 50%

E= margin of error=5%, the sample size will be 92.

Keeping 10% non-responsive rate the total sample size was 104.

Before starting the survey, approval was taken from the ethics committee of COMSTH-IRC with ref. no. 2020-069. An electric version of the questionnaire was sent to all the dentists working in Chitwan. with information about the principal investigator, purpose, and confidentiality. The structured survey was comprised of 27 questions containing multiple choices and multiple selections with options for write-in answers where appropriate. The survey comprises questions about demographic information, qualification, experience and knowledge, and practice of newer materials and techniques during endodontic treatment. Respondents were instructed to complete the questionnaire within a week. Three weeks after the first mailing, non-respondents were identified and reminders were sent. Respond were first rechecked for full responses by a single operator and not fully answered questionnaires with a majority of blank answers and those who don't perform endodontic practice were excluded. Finally, 104 respondents were included in this study. The data were collected in a spreadsheet and simple descriptive statistical analysis was performed using SPSS software version 22 to get the results in percentages and frequencies.

RESULTS

The results obtained through a descriptive statistical analysis of the collected data are given as absolute percentage and frequency in Table 1, 2 and 3, and Figure 1, 2, 3 and 4. Of the 120 questionnaires distributed, 108 participated in the survey. Four of them were excluded as they didn't perform endodontic treatment.

Table 1: Socio-demographic data

Study variables / questions	Measurement scales/answers	Frequency (%)
Age	Self-fill-in	Mean: 27.44±3.75
Gender	Female	59 (56.7)
	Male	45 (43.3)
Degree/ level of qualification	General practitioner	82 (78.8)
	General practitioner with endodontic training skills	8 (7.7)
	Endodontist	3 (2.9)
	Specialist	11 (10.6)
How many years have you been practicing dentistry?	< 2 years	69 (66.3)
	3-5 years	21 (20.2)
	6-10 years	9 (8.7)
	>10 years	5 (4.8)

Table 2: Materials used during endodontic treatment

Study variables / questions	Measurement scales/answers	Frequency (%)
Which radiograph do you use?	1) Conventional;	54 (51.9)
	2) Digital	50(48.1)
What sort of isolation methods/ materials do you use when treating teeth endodontically?	1) Cotton Gauge;	5 (4.8)
	2) Cotton gauge with suction;	97 (93.3)
	3) Rubber dam;	1 (0.9)
	4) Suction only;	1(0.9)
	5) Other:(self-fill-in)	0
If the isolation method is rubber dam system, how often do you use it?	1) Always;	1 (0.9)
	2) Sometimes;	19 (18.3)
	3) Never	84 (80.8)
Which file do you prefer for cleaning and shaping the root canal?	1) K files;	85 (81.7)
	2) H-files;	4 (3.8)
	3) Reamers;	1 (0.9)
	4) NiTi rotary files;	5 (4.8)
	5) Niti Hand files	9 (8.7)
Do you use Gates-Glidden drill?	1) Always;	0
	2) Sometimes;	52 (50)
	3) Never	52 (50)
How do you sterilize the endodontic files?	1) Autoclave;	49 (47.1)
	2) Glassbead sterilization;	46 (44.2)
	3) Cidex;	7 (6.7)
	4) Discard after use;	0
	5) Spirit swab	2 (1.9)

If you use sodium hypochlorite as one of the irrigants, what concentration do you use?	Self-fill-in	
	1) <1.5%	6(5.8)
	2) 1.5-3%	33 (31.7)
	3) 3-5%	62(59.6)
	4) >5%	3(2.9)
What kind of material do you use to fill the root canal space?	1) Gutta Percha;	104
	2) Silver points;	0
	3) MTA;	0
	4) Dental cement;	0
	5) Other: (self-fill-in)	0
What type of sealer do you use for obturation?	1) Zinc oxide Eugenol based;	79 (76)
	2) MTA based;	0
	3) Resin-based;	15 (14.4)
	4) Calcium hydroxide based;	10 (9.6)
	5) Bioceramic sealer;	0
	6) Other: (self-fill-in)	0
What temporary filling do you use between appointments when performing root canal treatment?	1) Zinc oxide eugenol filling;	8 (7.7)
	2) Glass ionomer;	3 (2.9)
	3) Cavit;	93 (89.4)
	4) Other: (self-fill-in)	0

Table 3: Technique and practice of endodontic treatment

Study variables	Measurement scales/answers	Frequency (%)
How do you take working length?	1) IOPA-R	89 (85.6)
	2) IOPA-R + Apex locator	15 (14.4)
	3) Apex locator	0
	4) Other:(self-fill-in)	0
What method do you prefer for cleaning and shaping the root canal?	1) Step-back technique	88(84.6)
	2) Crown Down technique	6(5.8)
	3) NiTi rotary	5(4.8)
	4) Hybrid technique	5(4.8)
	5) Other:(self-fill-in)	0
Do you perform the single-visit endodontic treatment?	1) Always	0
	2) Sometimes	55 (52.9)
	3) Never	49 (47.1)
In how many visits, on average, do you finish endodontic treatment of a single canaled tooth?	Self-fill-in	
	1) 2 visits	17(16.3)
	2) 3 visits	66(63.5)
	3) 4 visits	15(14.4)
	4) Depends on periapical radiolucency	6(5.8)
In how many visits, on average, do you finish endodontic treatment of multi canaled tooth?	Self-fill-in	
	1) 2 visits	2(1.9)
	2) 3 visits	18(17.3)
	3) 4 visits	47(45.2)
	4) 5 visits	26(25)
	5) 6 visits	3(2.9)
	6) Depends on periapical radiolucency	8(7.7)
During multi-visit treatment, after how many days do you recall the patient?	Self-fill-in	
	1) <1 week	50(48.1)
	2) 1-2 weeks	40(38.5)
	3) 2-4 weeks	11(10.6)
	4) >4 weeks	1(0.9)
	5) Depends upon infection	2(1.9)

What obturation technique do you use?	1) Cold lateral compaction	85(82.7)
	2) Warm vertical compaction	1(0.9)
	3) Single cone technique	17(16.3)
	4) Other: (self-fill-in)	0
Do you take an x-ray after completion of the endodontic treatment?	1)Yes	81 (77.9)
	2)No	2 (1.9)
	3)Maybe	21 (20.2)
After restoring the root canal space, when do you seal the coronal portion?	1) Same day of obturation	68 (65.4)
	2) After one week of obturation	31 (29.8)
	3) After 2 weeks of obturation	1 (0.9)
	4) After healing of periapical pathology	4 (3.8)

The questionnaire was answered by a wide range of dentist, the youngest responded being 23 years while the oldest 37 years of age The mean age group of the participants was 27.44±3.75. 81.6% of total respondents were of age group less than 30 years. 56.7 % were female and 43.3 % were male. 63.3% of respondents have less than 2 years of experience. 78.8% were general dental practitioners (GDP). Regarding the frequency of radiograph as shown in Figure 1, Most of the respondents (62.5%) take IOPA x-ray throughout the procedure.

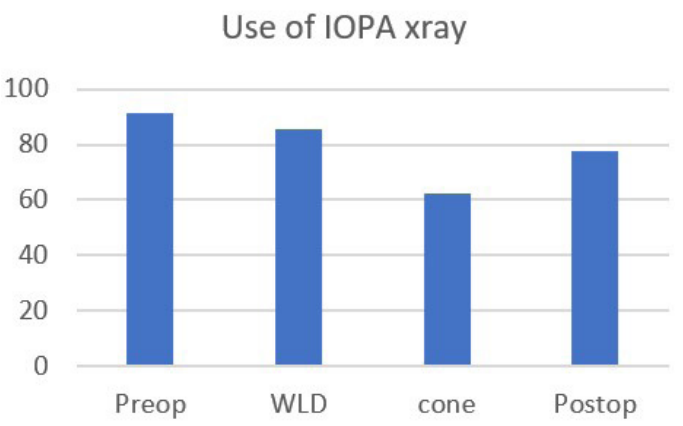

Figure 1: Frequency of radiograph taken for pre-operative (preop), working length determination (WLD) , cone fit (cone), and postoperative (postop) in percentage

Cotton rolls with suction is the most common (93.3) methods used for isolation whereas 80.8% of the respondent never used rubber dam. Radiograph with a file in the canal is the most common (85.6%) method for working length determination whereas only 14.4% used electronic apex locator (EAL). K-files are the most common (81.7%) file system used for root canal preparation whereas only 4.8% uses NiTi rotary file system with 84.6% follow step back technique for instrumentation of root canal.

For irrigation of root canals, normal saline (100%) and sodium hypochlorite (93.3%) are the most frequently used irrigants. (Figure 2) 3% sodium hypochlorite was the most popular (64.9 %) strength for irrigation.

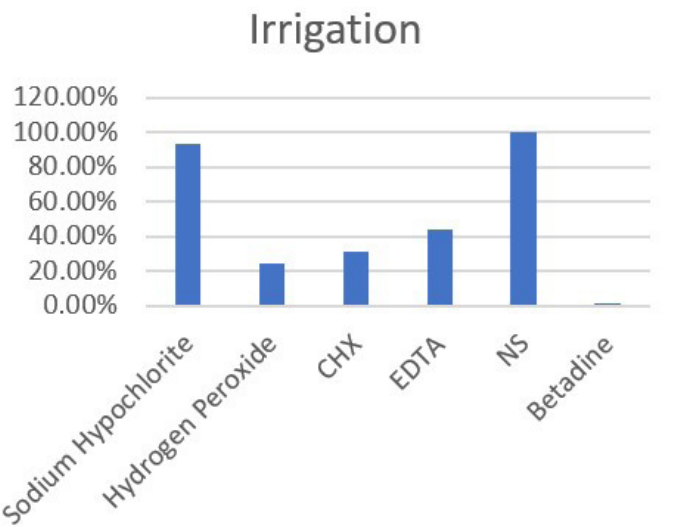

Figure 2: Use of Irrigants during endodontic treatment

Calcium hydroxide (89.4%) and triple antibiotic paste (51.9%) are the two most frequently used intracanal medicaments (Figure 3).

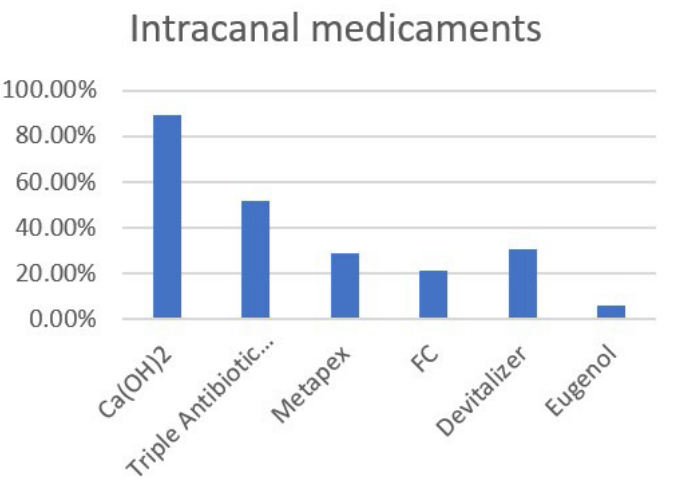

Figure 3: Use of Irrigants and intracanal medicaments during endodontic treatment

Respondents normally prefer multiple sitting endodontic

treatment with only 52.9% respondent perform SVE occasionally. Most of the respondents (63.5%) complete endodontic treatment of a single canal tooth in 3 visits and for multiple canal tooth, most of them (45.2%) take 4 visits. 48.1% of respondents recall patients within 1 week and 38.5% recall patients within 1-2 weeks. Gutta Percha is the only obturating material used. 76% of respondents use Eugenol based sealer. 82.7% of the respondent obturate the canal in cold lateral condensation technique. Cavit (89.4%) is the most popular temporary filling material. Most (65.4%) of the respondent perform coronal restoration after endodontic treatment on the same day of obturation. Regarding consultation for an endodontist, most of GDP (86.3%) refer for difficult cases (Figure 4).

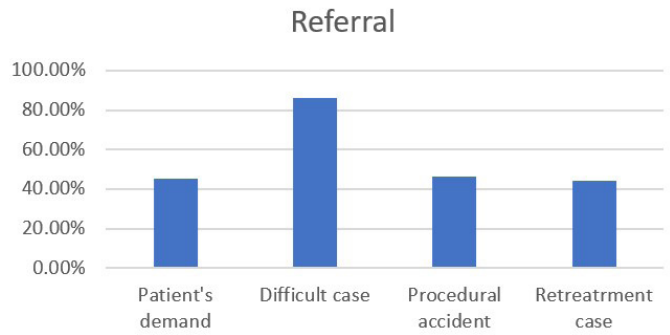

Figure 4: Reasons for a consultation with the endodontist

DISCUSSION

Similar studies were performed before in Kathmandu, Nepal but do not include the experience of the practitioners, type of radiograph, isolation medium, recall period, temporary filling material, time for coronal restoration, and cause for referral to an endodontist.[11] This study is also important to ascertain what has changed during the last 6 years.

During an endodontic procedure, a radiograph is the most important diagnostic aid which guides the procedure in every step. Radiograph before initiation of treatment provides the need for endodontic treatment, a gross idea about the anatomy of the root canal, length of the root, and difficulty levels for treatment.[15] Radiograph during treatment benefits the practitioner by estimating and confirming the length of root canals before and during instrumentation, localizing the pulp canal in calcified and/or receded root canal by examining the position of the instrument within the root, determining the facio-lingual position of roots, confirming position and adaptation of primary filling material and evaluation of the final root canal filling.[16] Most of the respondents (91.3%) in this study perform preoperative radiograph similar to other studies which support the importance of pre-operative radiograph during endodontic treatment.[6, 7, 11-13]

Verification of root canal preparation before obturation and after filling of the root canal is as important to assess and confirm the position of root canal filling material before cementation. This prevents overfilling reducing post-operative pain/ flare-ups. In this study, 62.5% take radiograph for cone-fit. After obturation, radiograph must be taken to find the quality of root canal filling. Correction of under or over obturation of the root canal can be performed immediately as GP remains soft and sealer does not set immediately which allows to remove GP easily. In this study, 77.9% take an x-ray after obturation of the canal similar to the study conducted in Kathmandu.[11] Though no significant difference was found between conventional and digital radiographs for diagnosis and accuracy of WLD, a technique that is quicker, cheaper during processing, and minimal time consuming without manual fixing and developing is the most desired approach. In this study 51.9% use conventional radiographs.

For complete disinfection of root canal, proper isolation of the working area is utmost. Rubber dam isolation is found to be the most important in endodontic treatment that creates a clear, contamination-free working area enhancing visibility, and prevents accidental inhalation and ingestion of instruments and irrigating solutions escaping into the oral cavity. Use of rubber dam also influences the choice of irrigants that affect the outcome of the treatment.[17] Although the use of rubber dam is found to be standard protocol, most (93.3%) of respondent use cotton rolls with suction for isolation similar to other studies.[6-9, 11, 13, 14] Use of rubber dam by GDP is found to be minimal (less than 1%) contradictory to study conducted in Switzerland and Kathmandu which found use of rubber dam was high with endodontist and GDP with endodontic practice.[9, 10]

WLD also limits the extent of root canal preparation, irrigants, and root canal filling material within the canal. Though various methods have been advocated for WLD, radiographic method with a file present inside the canals is most common. Variations in the point of reference and apical constriction result in an error of WLD and that influences the position of endodontic filling.[18] Development of EAL made WLD more easy and accurate which works on the fact that the electrical conductivity of the tissues surrounding the root apex is greater than the conductivity inside the root canal system being the channel dry or filled by nonconductive fluid. Systematic review has shown that EAL is found to be more accurate than radiographic findings. [19] EAL reduces the number of radiographs and is very useful in certain anatomical variations where the apical portion of the canal is obscure such as impacted teeth, tori, zygomatic arch, excessive bone density, overlapping roots, or shallow palatal vault.[20] However, both methods are not 100% accurate and therefore combination technique has been advocated for the correct WLD. In this study 85.5% of respondent uses the radiographic method for WLD which is similar to other studies.[6, 8, 11, 14]

After working length determination, cleaning and shaping of the root canal is performed to eliminate infected soft and hard tissues as well as provide assess for irrigants and root canal filling material to the apical space and at the same time maintain its original form preserving as much tooth structure as possible.[11] GG drill is used for coronal flaring to obtain straight line access which was used by 50% of the respondent similar to studies performed in Karachi, Mumbai.[12, 13] Most (81.7%) of the respondents use K-file for instrumentation similar to other studies.[6, 11, 13] Only 4.8% respondent uses rotary file system contradictory to studies

conducted by Zaugg et.al. and Rajbhandari et.al.[9, 10] 84.6% perform stepback technique for instrumentation and root canal preparation similar to study performed by Shrestha et.al., Vaitkus L., Siddiqui et.al. [7, 11, 12]

During instrumentation of root canal, irrigation plays a very important role in cleaning and disinfection of root canal system and also provides lubrication for the instruments that reduce the strain over the instrument and prevent instrument separation in the canal. Sodium hypochlorite, the most widely used endodontic irrigants, dissolves the organic material and possesses a broad-spectrum antimicrobial activity against endodontic microorganisms and biofilm, including microbiota difficult to eradicate from root canals. It also provides a lubricating function that enhances the action of rotary files.[21] Sodium hypochlorite (93.3%) and normal saline (100%) are mostly used irrigants by the respondents similar to other studies.[7, 9-14] 62% of the respondent uses 3% of sodium hypochlorite and only 2.9% use >5% of sodium hypochlorite for irrigation contradictory to studies performed in Mumbai and North Jordan which found most of the GDP use <3% of sodium hypoclorite.[8, 13]

Nowadays single visit endodontic (SVE) treatment has gained popularity due to its certain advantages like reduced flare-up rate, good patient acceptance, less time consuming, less painful, and less traumatic than multiple visits.[22] SVE treatment aims to eliminate bacteria and its byproducts during irrigation or render them harmless by entombing them by complete and three-dimensional obturation which deprives the micro-organisms of nutrition and the space required to survive and multiply.[23] However, meta-analysis found no detectable difference in the effectiveness of root canal treatment in terms of clinical and radiologic success between single and multiple visits.[24]Most of the respondent in the study did not perform single sitting endodontic treatment in their regular clinical practice similar to other studies which may be due to practice management, operator convenience, complexity of cases or weeping canal.[8, 10, 12] Only 52.9% dentist perform single sitting endodontic treatment occasionally. 63.5% respondent complete single rooted tooth in 3 visits and 45.2% complete endodontic treatment of multi rooted tooth in 4 visits which is similar to Iqbal et.al.[6]

Intracanal medicaments are mostly used during multi-visit endodontic treatment to eradicate bacteria and secondary infection from the canal. Calcium hydroxide (CH) is the most popular intracanal medicament for reducing bacterial load, stopping inflammatory exudates, and inducing hard tissue formation.[25] In the study CH is most (89.4%) commonly used intracanal medicaments similar to other studies.[7, 9-11, 14]

Provisional restorative material plays a pivotal role in sealing a root canal that prevents contamination of root canals from food debris, oral fluids, and microbes as well as prevents the escape of medicaments that were placed in the root canal system. Degradation of temporary filling material due to absorption of water or saliva cause dimensional changes, microleakage, loss of retention resulting in a poor prognosis of endodontic treatment.[26, 27] Proper selection of temporary filling material determines the recall visit duration. Study found that sealing ability was least for Cavit and high-water sorption and solubility compared to intermediate restorative material (IRM) and Glass ionomer cement (GIC). The good sealing ability of Cavit may be due to its hygroscopic nature and high setting expansion. But cavit lacks mechanical properties and hence the thickness of cavit must remain around 3.5 mm.[26] Due to its ease of availability and ease to use, 89.4% of the respondents use Cavit as temporary filling material.

Depending upon intracanal medicaments and provisional restorative material, recall time during multi-visit endodontic treatment varies. Studies have shown that triple antibiotic paste (TAP) completely eradicates E.faecalis from the root canal within 7 days[28], and CH is found to be effective within 7 days.[29] In this study 48.1% of respondents recall patients within 7 days.

The clinical success of any endodontic treatment is dependent on the complete seal of the root canal as well. The three-dimensional sealing ability of obturating material leads to a decreased risk of apical microleakage and as a result increased success rate of endodontic treatment. Root canal sealer provides hermetic seal filling the space between the dentinal wall and the obturating core interface, voids, and irregularities in the root canal, lateral and accessory canals.[30] Meta-analysis has shown tricalcium silicate-based sealer posses the least leakage among all the sealers and also contains antibacterial properties and excellent biocompatibility.[31] However, the preferred root canal sealer by 76% of the respondent was zinc-oxide eugenol based similar to other studies.[7, 8, 11, 13, 14]

Gutta Percha is the only obturating material used in this study. Though warm vertical condensation technique is the best obturation technique mentioned in the last decade with greater GP fill but posses certain disadvantages like apical extrusion of filling material, instrument fracture, inability to fill the curved canal, and uncontrolled heat generation that harm periodontal tissues.[32] 82.7% of respondent follow cold lateral condensation technique similar to other studies.[6, 7, 10-14]

The complex miniature architecture of endodontic files makes pre-cleaning and sterilization difficult. Though chemical sterilization and glass bead sterilization are found to be common chair-side sterilization methods, only proper autoclaving produces completely sterile instruments.[33] 47.1% of respondent autoclave for sterilization similar to India [13, 14] followed by glassbead sterilization by 44.2% contradictory to study conducted by Shrestha et.al. in Kathmandu which shows glassbead sterilization is performed by most of the GDP followed by autoclave for sterilization.[11]

A proper referral system improves the quality of treatment. American Association of Endodontist (AAE) has developed a form that measures the difficulty level providing proper referral area.[34] 86.3% refer difficult cases for endodontic consultation similar to studies performed by Gupta et.al. and Vaitkus L.[7, 14]

Use of newer technique during proper isolation medium, a file system for root canal cleaning and shaping, obturation technique, the sealer was more significant in endodontist.[9, 10]

Proper knowledge, skills and cost factor limits the use of newer materials and techniques by the GDP. Further studies must be carried out to know the cause of failure to adopt the international endodontic protocol and make policies to overcome all the difficulties that limit the use of the international protocol.

CONCLUSION

Proper use of recently advanced materials and methods require proper skills and knowledge. Along with lack of continuing dental education courses, financial factors also restrict to adopt newer materials and techniques. It is the responsibility of the academics and dental schools to prepare their students to adopt the guidelines and recommended standards in root canal debridement, shaping, and obturation.

CONFLICT OF INTEREST: None

FINANCIAL DISCLOSURE: None

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